# Agilent N8262A P-Series Modular Power Meter

## User's Guide

Agilent Technologies

# Notices



## Manual Part Number

N8262-90001

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# Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies, Inc. assumes no liability for the customer's failure to comply with these requirements.

# Safety Notices

**WARNING**

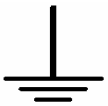
**A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or loss of life. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

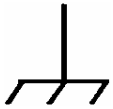
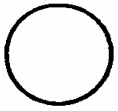
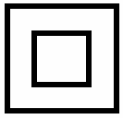
**CAUTION**

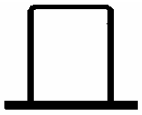
A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

## Safety Symbols

The following symbol on the instrument and in the documentation indicates precautions that must be taken to maintain safe operation of the instrument.

| | |
|---|---|
|  | Caution, risk of danger.<br>The Instruction Documentation Symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the supplied documentation. |
|  | Alternating current (AC). |
|  | This symbol indicates the operating switch for 'Stand-by' mode. Note, the instrument is NOT isolated from the mains when the switch is pressed.<br>To isolate the instrument, the mains coupler (mains input cord) should be removed from the power supply. |
|  | Direct current (DC). |
|  | Both direct and alternating current. |
|  | Three-phase alternating current. |
|  | Earth (ground) TERMINAL. |

| | |
|---|---|
|  | PROTECTIVE CONDUCTOR TERMINAL. |
|  | Frame or chasis TERMINAL. |
|  | Equipotentiality. |
|  | On (Supply). |
|  | Off (Supply). |
|  | Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION. |
|  | Caution, risk of electric shock. |
|  | Caution, hot surface. |
|  | In position of bi-stable push control. |

| | |
|---|---|
|  | Out position of bi-stable push control. |

## Regulatory Markings

| | |
|---|---|
| CE<br>ISM 1- A | The CE mark shows that the product complies with all the relevant European legal Directives (if accompanied by a year, it signifies when the design was proven). |
| C US<br>206349 | The CSA mark is a registered trademark of the Canadian Standards Association. A CSA mark with the indicators “C” and “US” means that the product is certified for both the U.S. and Canadian markets, to the applicable American and CAnadian standards. |
| N10149 | The C-tick mark is a registered trademark of the Spectrum management Agency of Australia. This signifies compliance with the Australian EMC Framework regulations under the terms of the Radio Communications Act of 1992. |
|  | This product complies with the WEEE Directive (2002/96/EC) marking equipment. The affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste. |
| ICES/NMB - 001 | This ISM device complies with the Canadian ICES-001 |

# General Safety Information

This is a Safety Class I instrument (provided with a protective earthing ground, incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

**WARNING**

- **DO NOT operate the product in an explosive atmosphere or in the presence of flammable gasses or fumes.**
- **DO NOT use repaired fuses or short-circuited fuseholders: For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type.**
- **DO NOT perform procedures involving cover or shield removal unless you are qualified to do so: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only.**
- **DO NOT service or adjust alone: Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, service personnel must not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.**
- **DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a Agilent Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.**
- **DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Agilent Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.**

**CAUTION**

- Applying excessive voltage or overloading the device will cause irreversible damage to the circuitry.
- Use the device with the cables provided.

# Waste Electrical and Electronic Equipment (WEEE) Directive 20002/96/EC

This instruction complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is shown as below:

### Do not dispose in domestic household waste

To return this unwanted instrument, contact your nearest Agilent office, or visit

www.agilent.com/environment/product

for more information.

| Agilent Technologies | **DECLARATION OF CONFORMITY**<br>According to EN ISO/IEC 17050-1:2004 | CE |
|---|---|---|

**Manufacturer's Name:** Agilent Technologies Microwave Products (M) Sdn. Bhd
**Manufacturer's Address:** Bayan Lepas Free Industrial Zone,
11900, Bayan Lepas, Penang, Malaysia

**Declares under sole responsibility that the product as originally delivered:**

**Product Name:** P-Series Modular Power Meter
**Models Number:** N8262A
**Product Options:** This declaration covers all options of the above product(s)

**complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:**

Low Voltage Directive (2006/95/EC)
EMC Directive (89/336/EEC, amended by 93/68/EEC)

**and conforms with the following product standards:**

**EMC**

| Standard | Limit |
|---|---|
| IEC 61326:2002 / EN 61326:1997+A1:1998+A2:2001+A3:2003 | |
| CISPR 11:1990 / EN55011:1990 | Class A Group 1 |
| IEC 61000-4-2:1995 / EN 61000-4-2:1995 | 4 kV CD, 8 kV AD |
| IEC 61000-4-3:1995 / EN 61000-4-3:1996 | 3 V/m, 80-1000 MHz |
| IEC 61000-4-4:1995 / EN 61000-4-4:1995 | 0.5 kV signal lines, 1 kV power lines |
| IEC 61000-4-5:1995 / EN 61000-4-5:1995 | 0.5 kV line-line, 1 kV line-ground |
| IEC 61000-4-6:1996 / EN 61000-4-6:1996 | 3 V, 0.15-80 MHz |
| IEC 61000-4-11:1994 / EN 61000-4-11:1994 | 1 cycle / 100% |

Canada: ICES-001:2004
Australia/New Zealand: AS/NZS CISPR11:2004

The product was tested in a typical configuration with Agilent Technologies test systems.

**Safety** IEC 61010-1:2001 / EN 61010-1:2001

Canada: CAN/CSA-C22.2 No. 61010-1-2004
USA: ANSI/UL 61010-1:2004

C SP® US 206349

**Supplementary Information:**

**This DoC applies to above-listed products placed on the EU market after:**

8 June 2007
Date

**Mack Soh**
Quality Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor, or Agilent Technologies Deutschland GmbH, Herrenberger Straße 130, 71034 Böblingen, Germany.

Template: A5971-5302-2, Rev. D.00 N8262A DoC Revision 1.0

**Product Regulations**

**EMC**

| | Performance Criteria |
|---|---|
| IEC 61326-1:2002 / EN 61326-1:1997+A1:1998+A2:2001+A3:2003 | |
| CISPR 11:1990 / EN 55011:1990 – Group 1 Class A | |
| IEC 61000-4-2:1995 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD) | B |
| IEC 61000-4-3:1995 / EN 61000-4-3:1996 (3V/m, 80% AM) | A |
| IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth) | B |
| IEC 61000-4-5:1995 / EN 61000-4-5:1995 (Surge 0.5kV line-line, 1kV line-earth) | B |
| IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V, 0.15~80 MHz, 80% AM, power line) | A |
| IEC 61000-4-11:1994 / EN 61000-4-11:1994 (Dips 1 cycle, 100%) | B |
| Canada: ICES-001:2004 | |
| Australia/New Zealand: AS/NZS CISPR11:2004 | |

**Safety** IEC 61010-1:2001 / EN 61010-1:2001
Canada: CAN/CSA-C22.2 No. 61010-1-2004
USA: ANSI/UL 61010-1:2004

**Additional Information:**
The product herewith complies with the essential requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly (European Union).

**[1]Performance Criteria:**
A Pass - Normal operation, no effect.
B Pass - Temporary degradation, self recoverable.
C Pass - Temporary degradation, operator intervention required.
D Fail - Not recoverable, component damage.
N/A – Not applicable

**Notes:**

**Regulatory Information for Canada**
ICES/NMB-001:2004
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est confomre à la norme NMB-001 du Canada.

**Regulatory Information for Australia/New Zealand**
This ISM device complies with Australian/New Zealand AS/NZS CISPR11:2004
**N10149**

# In This Guide ...

1 **Introduction** Chapter 1 introduces you to the Power Meter GUI (known as P-Series Soft Front Panel in this guide) and display of the P-Series Modular Power Meter.

2 **General Power Meter Functions** Chapter 2 describes the general operation of the P-Series Modular Power Meter.

3 **Using P-Series Power Sensor** Chapter 3 describes how to use your P-Series Power Sensor with your P-Series Modular Power Meter.

4 **Maintenance** Chapter 4 describes the built in tests, error messages and general maintenance.

5 **Specifications and Characteristics** Chapter 5 describes the specifications and characteristics of your P-Series Modular Power Meter.

# Contents

# List of Figures

# List of Tables

# 1 Introduction



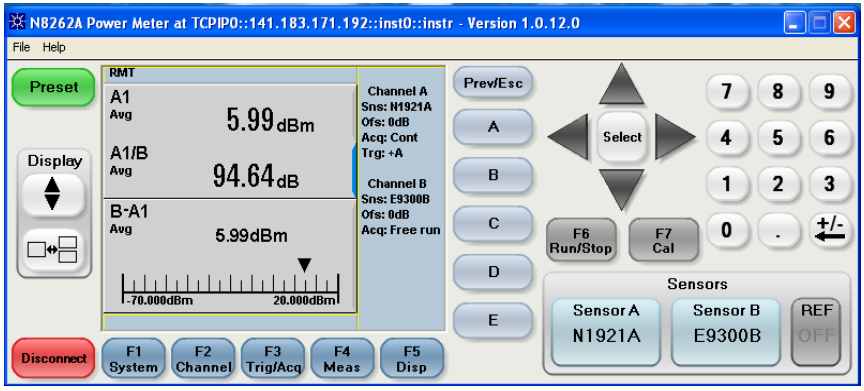
This chapter introduces you to the Power Meter GUI (known as P-Series Soft Front Panel in this guide) and display of the P-Series Modular Power Meter.

# Product Overview

The N8262A P- Series Modular Power Meter, **LXI Class C** compliance instrument is an upgrade of P- Series Power Meter. It is developed using LXI Technology. LXI, an acronym for LAN eXtension for Instrumentation, is an instrument standard for devices that use the Ethernet (LAN) as their primary communication interface.

When using the N8262A, a virtual user interface runs on a Windows based controller will give you manual control over the operation of the power meter. This interface is emulated from the P- Series Power Meter's soft front panel display where Standard Commands for Programmable Instrumentation (SCPI) commands exist to access desired funtionality.

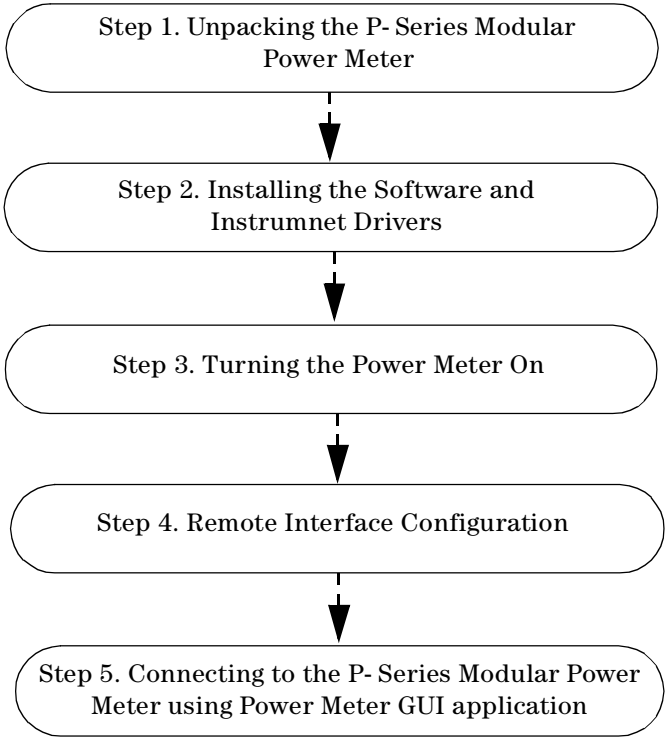
N8262A operates with three software: Web Browser Interface, P- Series Soft Front Panel and Synthetic Instrument Finder. It offers identical measurement performance as P- Series Power Meter. Operation of the N8262A occur by using a virtual panel hosted on PC or via the remote programming interface : Soft Front Panel. It provides robust instrument control and works with the environment you choose.




**P- Series Soft Front Panel**

# Getting Started

Make sure you have gone through the Installation Guide before you proceed.



# Power Meter and Sensor Capability

Your P- Series Modular Power Meter is compatible with Agilent P- Series, E- Series E9300, E- Series E4410 and the 8480 Series Power Sensors. However, not all sensor and meter combinations have the same features or capabilities. The main differences are as below:

| Features | P-Series N1920 | E-Series E9300 | E-Series E4410 | 8480 Series |
|---|---|---|---|---|
| Average power of CW signal | • | • | • | • |
| Average power of modulated signal | • | • | | • |
| Peak power | • | | | |
| Cal factors stored on EEPROM | • | • | • | |
| ≥200 readings/sec | • | • | • | |
| Peak/burst average power | • | | | |
| Time gated measurements | • | | | |
| Rising edge trigger | • | | | |
| Falling edge trigger | • | | | |

**NOTE** The E-Series and 8480 Series Power Sensors require N1917A/B/C cables when connected to the P-Series Modular Power Meters.

## Specifications

The specifications for the power meter are listed in Chapter 5, “Specifications and Characteristics,” starting on page 139.

# Conventions Used in this Guide

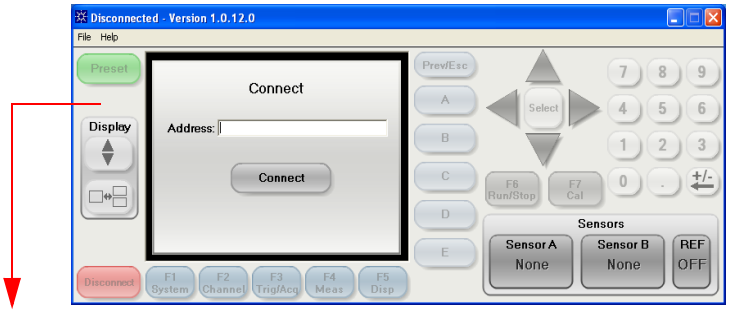
The following conventions are used throughout this guide.

| | |
|---|---|
|  | This symbol and text represents a labeled softkey on the P-Series Soft Front Panel. |
| **Softkey** | This symbol and text represents a labeled softkey at the display panel and is used to indicate that you should select the labeled softkey beside the displayed text. Alternatively, you can click on the indicated softkey to achieve similar button operation. |
| **Message** | This text represents a displayed message. |
| **Parameter** | This is used to represent a parameter, value, or title. |
| **"Channel"** | This User's Guide describes the operation for the dual channel power meter. To identify channels on a dual channel meter, select a softkey on of either **Channel A** or **Channel B**.<br><br>When you are asked to select "the channel" **Softkey** in a procedure, make sure you select the relevant channel. |

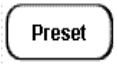
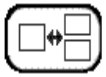
# P-Series Soft Front Panel Keys and Connections

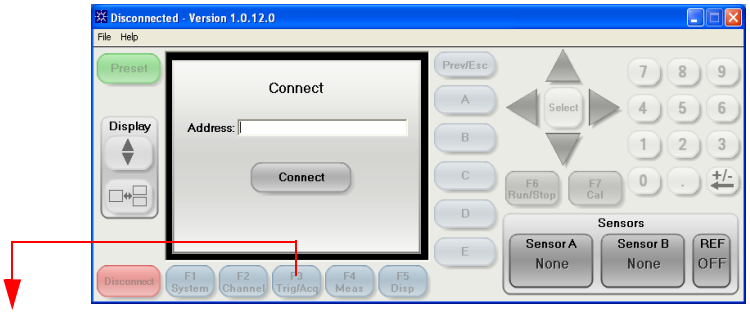
**NOTE** Make sure you have connected to the P-Series Soft Front Panel before you proceed. You may refer to *Installation Guide* for details.

This section briefly describes the functions of the soft front panel softkeys.



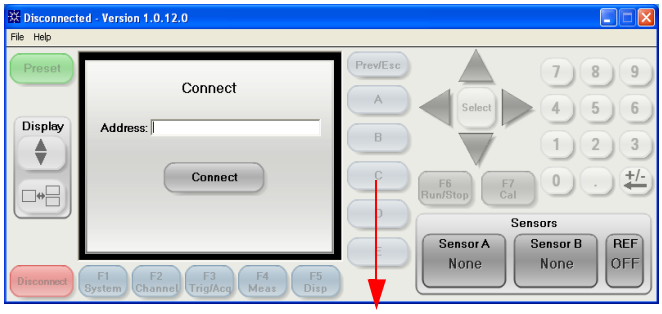

These softkeys are located to the left of the display.

| Key | Function |
|---|---|
|   | Click this softkey to preset the power-meter. An option list of pre-installed measurement configurations is presented. Select an option and click the confirm softkey. |
|  | Click this softkey to select the upper or lower measurement window. The selected window is highlighted by a blue line on the right side of the window. Any measurement setup you create is performed in the selected window. |
|  | Click this softkey to choose windowed, expanded, or full-screen display of a numeric measurement. It also provides quick access to the Gate Control screen and menu when a trace window is selected. |
|   | Click this softkey to switch off the soft front panel |



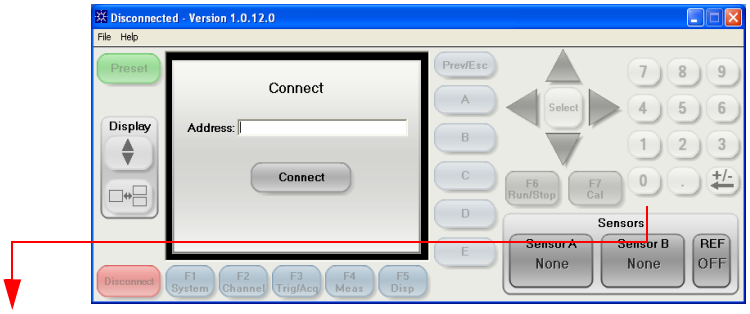

These softkeys are located along the lower edge of the display.

| Key | Function |
|---|---|
| F1 System | Click this softkey to access general configuration-menus, such as IP address. You can also access the Self-Test and Table entry menus. The measurement screen remains visible. |
| F2 Channel | Click this softkey to access the channel configuration menus. Channel parameters such as averaging and offsets are configured from this menu. |
| F3 Trig/Acq | Click this softkey to access the triggering menu. Unless a P-Series Sensor is connected, all the menu softkeys are disabled (grayed out). |
| F4 Meas | Click this softkey to setup relative measurements or set display offsets.<br><br>Use this softkey to configure the selected measurement. |
| F5 Disp | Click this softkey to access the measurement display menu. You can choose the displayed measurement resolution, units and display format.<br><br>Use this softkey together with F4 Meas to configure measurement displays. |

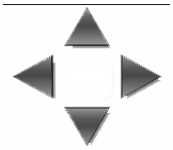
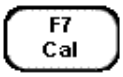



These softkeys are all associated with the menu labels and data entry. They are located to the right of the display.

| Key | Function |
|---|---|
| Prev/Esc | Click this softkey to return to the previous screen. This softkey also cancels pop-up entry. |
| A<br>B<br>C<br>D | These softkeys are referred to by the text on the display next to them.<br>For example, during a Preset, you are given an option to confirm the command. Click to continue, that is, click the softkey beside the displayed word 'confirm'. |
| E | This softkeys is used when there is a two page menu to be displayed. For example, a **1 of 2** is displayed beside the softkey indicating the first page of a two page menu. Click the softkey to access the next page or second page. (A **2 of 2** is displayed). |




These softkeys and connectors are associated with the measurement channels and are located on the right- hand side of the soft front panel.

| Key | Function |
|---|---|
|  | The arrow softkeys are used for navigation around the parameter entry screens. The up and down arrows are used for selecting values from a pop-up list, they can also be used for stepping two values, X Scale and Y Scale. They are also used to enter text, for example, table names. The arrow softkeys are presented individually as  ,  ,  and  . |
|  | Click this softkey to select a highlighted field to allow data entry, check a checkbox and terminate entry of a popup list. |
|  | Click this softkey to access the zero and calibration menus. |
|  | Click this softkey to start and stop the acquisition of the measurement. |
|  | Click these softkeys to enter numeric values in the pop-up fields, for example, the offset values. To complete the entry use the softkey. |

# The Display Layout

Figure 1- 1 shows the display layout when two windows are configured in dual numeric mode.

Clicking F5 Disp, **Disp Type** the other display formats are available.

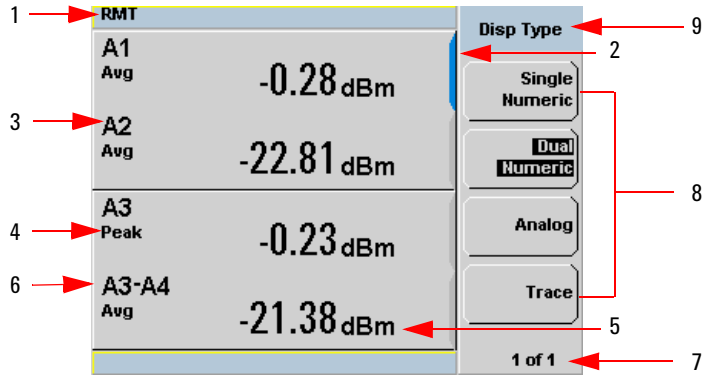



**Figure 1-1** Dual numeric display

**1** The status reporting line displays messages and the control status of the power meter. For example, the status can be display as **RMT** (remote).

The message fields indicate **ERR** for any error conditions that occur or informing you to **Please Zero** the power sensor.

**2** The blue highlight on the right hand side of the window shows it is the currently selected measurement display line. This measurement line is the Upper Window/Upper Measurement.

**3** The measured channel is shown. With a P- Series Power Sensor connected, and channel in trigger mode, the associated gate number is shown.

**4** The associated measurement type is shown below the channel and gate number.

**5** This displays the measurement units, either dBm, dB, Watts, or percent (%).

**NOTE** With a P-Series Power Sensor connected, a measurement result of –270 dBm indicates the input power level is beyond the sensitivity of the sensor.

**6** With a P- Series Power Sensor connected, you can make combined measurements with both channels.

**7** This displays the number of pages in the current menu. For example, **1 of 2** indicates that there are two pages in the menu and the first page is currently displayed. Pressing the softkey displays the next page, indicated by **2 of 2**. (Click the softkey to display the previous menu page.)

**8** The available softkey labels are displayed in these four fields. Additionally, settings associated with the labeled function are displayed under the label.

**9** This field displays the menu title. For example, **Channel Setup** or click F7 Cal and the **Zero/Cal** menu is displayed.

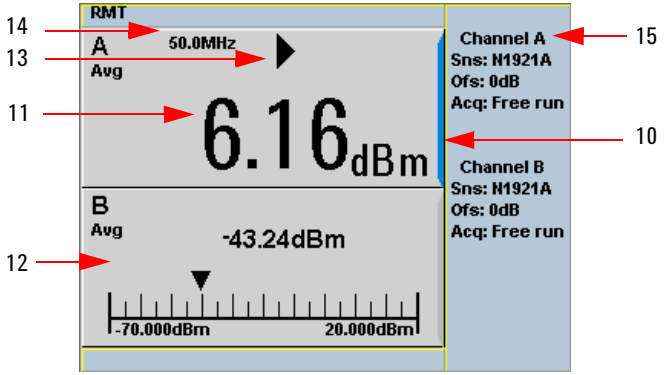



**Figure 1-2** Single numeric and analog display

**10** Figure 1-2 shows the default display mode of two measurement windows. The upper measurement window has a blue highlight on the right hand side of the window showing it has been selected.

Using the , or softkeys you can change the selection of the measurement window.

Using the softkey on numeric measurement results window you can choose either two rectangular windows, a single enlarged window, or a full screen display by pressing. The display style is applied to the currently selected window or measurement line.

**11** The upper window is configured to show a single numeric display.

**12** The lower window is configured to show an analog meter which displays the measurement result and the meter scaling.

**13** With a P- Series Power Sensor connected, the symbol shows the trigger state (Free Run), (Stopped), (Negative Slope), or (Positive Slope).

**14** The channel measurement frequency.

**15** This displays the connected sensor, the offset value, and the acquisition mode on the channel. On dual channel models it shows for both channels.

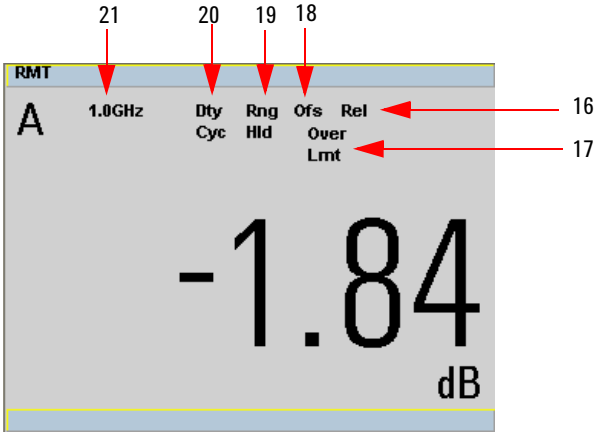



**Figure 1-3** Full screen numeric display

**16** Figure 1- 3 shows a single numeric full screen displaying a relative result.

This field displays **Rel** if relative mode is on.

**17** This field indicates the measurement result is beyond the configured upper or lower limit. If the measurement is within the limits this field is empty. If the measurement result is less than the minimum limit set, **Undr Lmt** is displayed. If the measurement result is more than the maximum limit set, **Over Lmt** is displayed.

**18** This field displays **Ofs** if an offset is set.

**19** This field displays **Rng Hld** if a range is selected.

**20** This field displays **Dty Cyc** if a duty cycle is set.

**21** The information in this field is displayed on two lines and depends on the sensor type, sensor calibration table, frequency dependent offset table currently selected, and the measurement frequency.

**NOTE** The following trace displays are only available when a P-Series Power Sensor is connected.

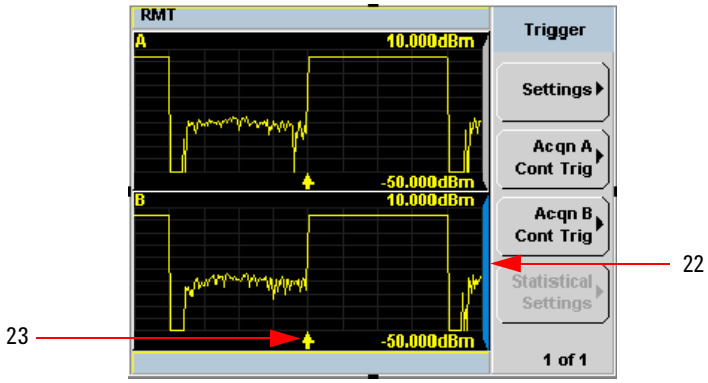



**Figure 1-4** Trace display in both windows

**22** Figure 1- 4 shows both windows configured to trace display mode. This is only available when a P- Series Power Sensor is connected. The captured trace, channel, and scaling are displayed. The lower window is the selected window.

**23** The ▲ indicates the point on the trace where trigger event occurs.

**NOTE** Single or continuous triggering ( **Sing Trig** or **Cont Trig** ) must be selected from the **Acqn** menu to view a trace window. The **Acqn** menu is accessed by clicking F3 Trig/Acq , **Trigger** . **Trace** is disabled when **Free Run** is selected.

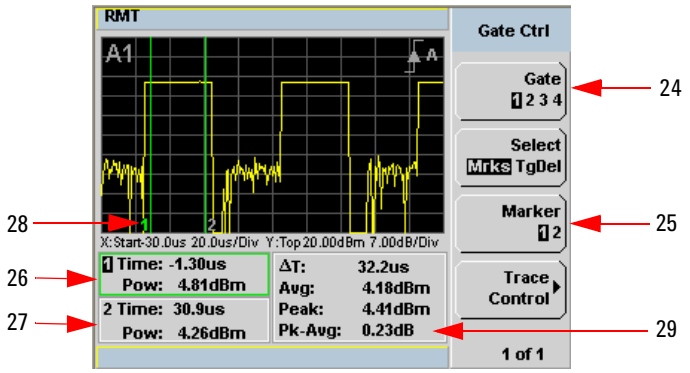



**Figure 1-5** Trace display in single enlarged window in markers mode

Figure 1-5 shows a single enlarged window with the **Gate Ctrl** menu and associated tables and markers. The **Gate Control** is the default display when using trace display.

**24** Clicking **Gate** scrolls through the 4 gates available for each channel.

**25** The markers, **1** and **2**, indicate the start and end points of the selected gate. Clicking **Marker** toggles between the two markers. You can use the ◀ and ▶ softkeys to move the active marker along the trace.

**26** The highlighted table, with the green border, shows the time (**Time:**) and the instantaneous power level (**Pow:**) of the active marker at the configured point. A negative time value indicates a measurement before the trigger point.

**NOTE** Gate timing parameters are all related to your chosen trigger point. This may be different from the timing of the triggering event if you have configured a trigger delay. Refer to item No 30 for more information.

**27** This table shows the time (**Time:**) and the instantaneous power level (**Pow:**) of the inactive marker at the configured point.

**28** The highlighted marker shows the active marker at the configured point.

**29** This table shows the width of the gate **ΔT:** (time between the markers), the average, peak, and peak-to-average ratio power measurements within the active gate.

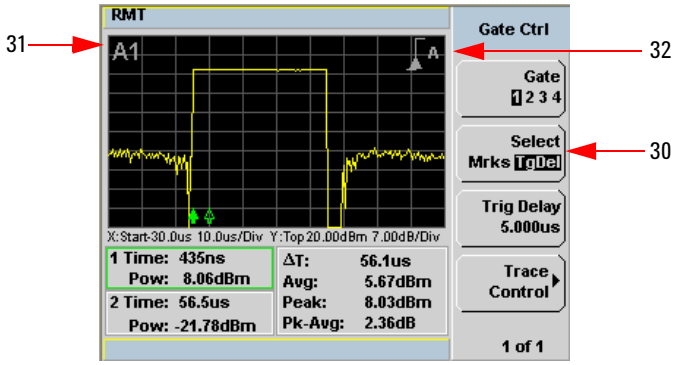



**Figure 1-6** Trace display in single enlarged window in trigger delay mode

Figure 1-6 shows a single enlarged window with the **Gate Ctrl** menu and associated tables and trigger delay.

**30** Clicking **Select TgDel** removes the gate markers and displays the trigger marker(s). The ▲ indicates when the trigger event occurs, whilst △ shows the delayed trigger point. When the two points coincide only the ▲ trigger is shown.

In the example shown in Figure 1-6, the △ appears ahead of the ▲ as a trigger delay of –5.00 µs has been configured, placing the measurement trigger before the trigger event. You can configure the trigger delay by pressing and entering a numeric value.

To indicate an off-screen trigger event, ◄ is displayed. To indicate an off-screen trigger point, ◁ is displayed.

**31** The selected channel and gate number is displayed.

**32** The trigger setting and slope is displayed. Examples shown in Figure 1-6 are Internal Channel A and a Positive Slope.

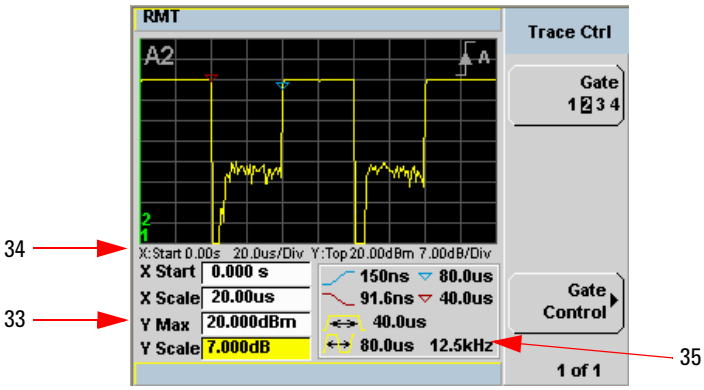



**Figure 1-7** Trace display in single enlarged window in trace control mode

Figure 1- 7 shows a single enlarged window with the **Trace Ctrl** menu with information on the pulse and associated X and Y control.

**33** This is the X and Y trace setup fields. Using the ⬆ or ⬇ softkeys you can highlight the item and change its value.

**34** The current settings of the X and Y scale are displayed in this reporting line.

**35** This table shows 7 automatic time measurements performed on the first complete captured pulse after the trigger. The 7 measurements are rise time , fall time , time to positive occurrence , time to negative occurrence , pulse period , pulse width and pulse repetitive frequency **12.5 kHz**.

# Window Symbols and Pop-ups

There are several different graphic symbols and pop- up windows that can occur on the power meter display. These can occur for a variety of reasons, for example:

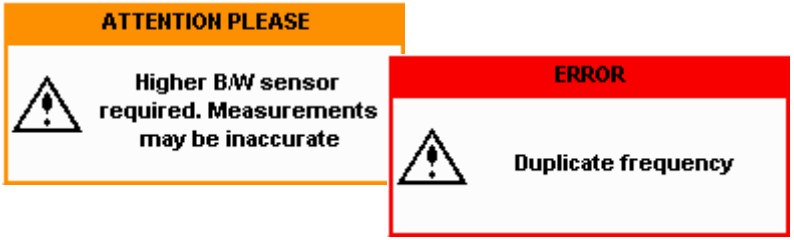
- An error or warning occurs
- You are required to wait while the power meter carries out a procedure
- You are required to select an entry from a list
- You are required to enter a numeric value

There are three different colors used to signify the pop- up status:

- Green - used to allow data entry
- Orange - used to display information
- Red - used to display an error

## Warning Symbol Pop-up

The warning symbol is displayed either in a pop- up window or directly in the measurement window when such an event occurs. A pop- up window is displayed for approximately two seconds. The text in the pop- up window gives details of the warning type, for example, to indicate that a power sensor has insufficient bandwidth or a previous entered frequency value in a table. Depending on the severity of the warning, the pop- up may be displayed in Orange or Red.



## Wait Symbol Pop-up

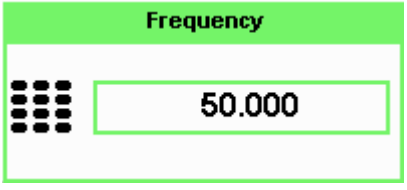
The wait symbol is displayed when the power meter is carrying out a procedure and no action is required from you. The symbol appears in a pop- up window. It may appear, for example, during a calibration.


## Confirm Symbol Pop-up

This type of pop- up window is displayed when you are required to click **Confirm** to verify your previous selection. For example, prior to a **Save** being carried out.

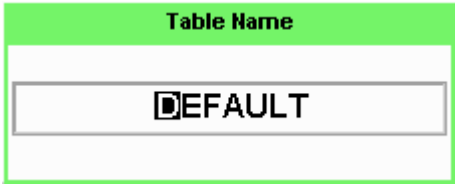

## Numeric Entry Pop-up

This type of pop- up window is displayed when you need to modify numeric data. The numeric softkeys allow you to enter the value.



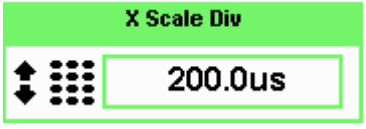
## Text Entry Pop-up

This type of pop- up window is displayed when you need to modify alphanumeric data, for example, table names. The up/down arrow softkeys increment and decrement the alphanumeric digit that the cursor is currently positioned. The left/right arrow softkeys move the cursor to another alphanumeric digit.



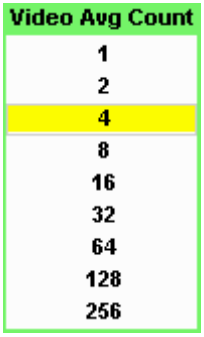

## Trace Scaling Pop-up

This pop- up window is displayed when you are in the **Trace Control** menu and you can either use the up/down arrow softkeys for increment and decrement, or the numeric softkeys to set, the values of the X scale and Y scale.



## List Pop-up

This pop- up window is displayed when you are required to select an entry from a list. Use the up/down arrow keys to highlight your choice. Click select to complete the entry.



# 1 Introduction

# 2
# General Power Meter Functions



This chapter describes the general operation of the P-Series Modular Power meter.

# Setting the Units of Measurement

The **Units** menu is used to select the measurement units for the currently selected window. These can either be logarithmic (dBm or dB) or linear (Watt or %) units. Presetting ( Preset ) the power meter sets the measurement units to dBm (logarithmic units). Table 2- 1 and Table 2- 2 show units that are applicable to each measurement mode.

Click F5 Disp , **Units** . Select the unit of measurement from **dBm** , **W** , **dB** , and **%** . Display softkeys which cannot be selected in your particular mode of operation are grayed out.

**NOTE** When the measurement unit is set to Watt (W), it is possible that negative power results are displayed when measuring low power levels.

**Table 2-1** Measurement units - Single channel measurement

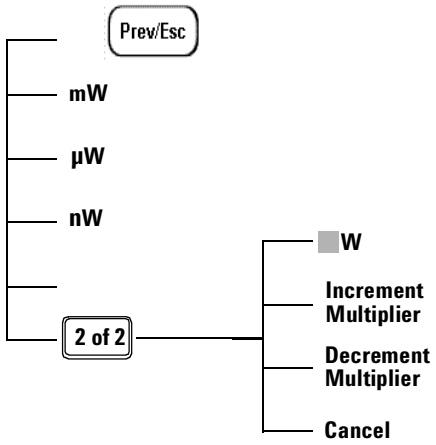
| Measurement Mode | Relative Mode Off | Relative Mode On |
|---|---|---|
| Log | dBm | dB |
| Linear | Watt | % |

**Table 2-2** Measurement units - Dual channel measurement

| Measurement Mode | | Relative Mode Off | Relative Mode On |
|---|---|---|---|
| Ratio | Log | dB | dB |
| | Linear | % | % |
| Difference | Log | dBm | dB |
| | Linear | Watt | % |

## Selecting Units of Measurement from the Softkeys

In some menus, for example, units in the **Trace Setup** menu, you are required to enter the units of measurement for power. In some cases, due to the availability of wide power range, the following menu is displayed:




Clicking **Increment Multiplier** or **Decrement Multiplier** increases or decreases the multiplier shown in front of **W**.Clicking **W** after the correct multiplier has been selected confirms the entry.

**NOTE** Invalid display softkeys are grayed out so the value cannot be entered.

# Setting the Measurement Frequency

Entering the frequency of the RF signal you are measuring optimizes the accuracy and minimizes measurement uncertainty, especially when making comparative measurements between signals.

### Procedure

Set the measurement frequency as follows:

1 Click F2 Channel. Click **Channel** to select the required channel.

2 Use the ▲ and ▼ softkeys to highlight the **Frequency** value field and click SELECT to display the **Frequency** pop- up. Use the numeric softkey pad to enter the required value in the **Frequency** pop- up window.

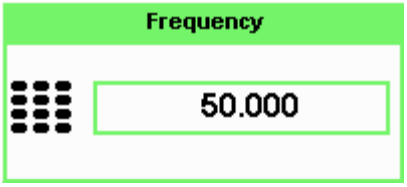



**Figure 2-1** Frequency pop-up

3 Confirm your choice by selecting **MHz** or **GHz**.

4 Click Prev/Esc to close the **Channel Setup** screen.

# Setting the Resolution

The resolution of each of the power meter's numeric type windows can be set to four different levels (1, 2, 3 or 4).

These four levels represent:

- 1, 0.1, 0.01, 0.001 dB respectively if the measurement suffix is dBm or dB.
- 1, 2, 3 or 4 significant digits respectively if the measurement suffix is W or %.

The default value is 0.01 dB (3 digits).

To set the resolution on the currently selected window:

1 Click F5 Disp. The current setting of the resolution is highlighted under the **Resolution** softkey.

2 To change this setting, click **Resolution** repeatedly until the required resolution setting is highlighted.

# Making Relative Measurements

Relative mode enables comparison of a measurement result to a reference value. The relative reading, or difference, can be displayed in either dB or % terms. When the measurement result is displayed in % a prefix multiplier may be shown.

### Procedure

1 Click F4 Meas to display the **Measurement Setup** menu.

Figure 2- 2 shows a **Measurement Setup** display and the relative measurement items labeled.

2 Select the window you wish to set a reference value on by clicking the Meas Select softkey. The currently selected window/measurement is displayed.

3 Use the ↑ and ↓ softkeys to highlight the **Relative** setting field.

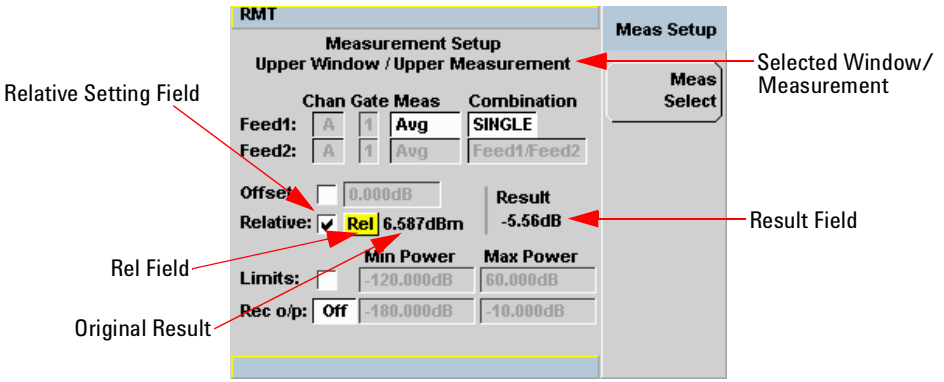



**Figure 2-2** Typical relative measurement display

4 Click SELECT to check the **Relative** setting field.

5 Confirm that the power meter is measuring the signal you want to use as the reference. This is displayed under the **Result** field.

6 Click the ◀ , ▶ softkeys to highlight the **Rel** field.

7 Click SELECT and the original result value will appear on the right hand side of the **Rel** check field.

8 The relative value displayed under **Result** field will change as the measured signal varies.

**NOTE** If you return the power meter to display the numeric display, a **Rel** symbol will be displayed in the measurement window it is applied to.

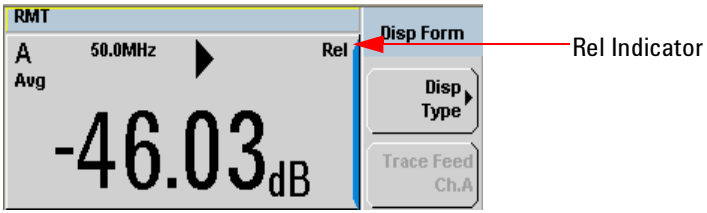



**Figure 2-3** Numeric display

**NOTE** The **Rel** symbol is not displayed when the associated measurement is displayed in **Dual Numeric** or **Analog** format.

# Setting the Pulse Reference Levels

- Click F1 System and proceed to the second page of **Sys/Inputs** menu by clicking the 1 of 2 softkey.
- Click Meas Config softkey to display the **Measurement Configuration** screen.
- Click the Channel A B softkey to select the desired channel.

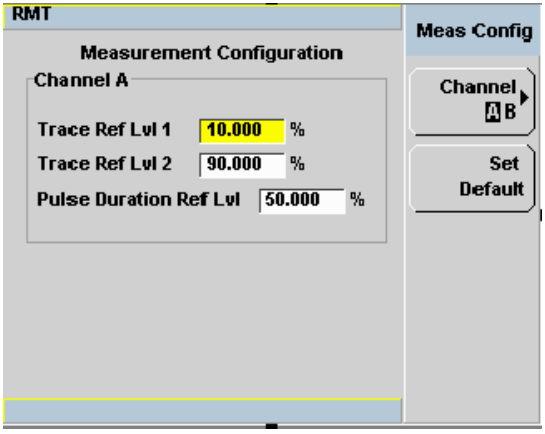



**Figure 2-4** Measurement configuration screen

**NOTE** Trace Ref Lvl 1 and Trace Ref Lvl 2 are used in calculation of transition durations and occurrences.

**NOTE** Pulse Duration Ref Lvl allows pulse duration measurements between non-standard reference levels.

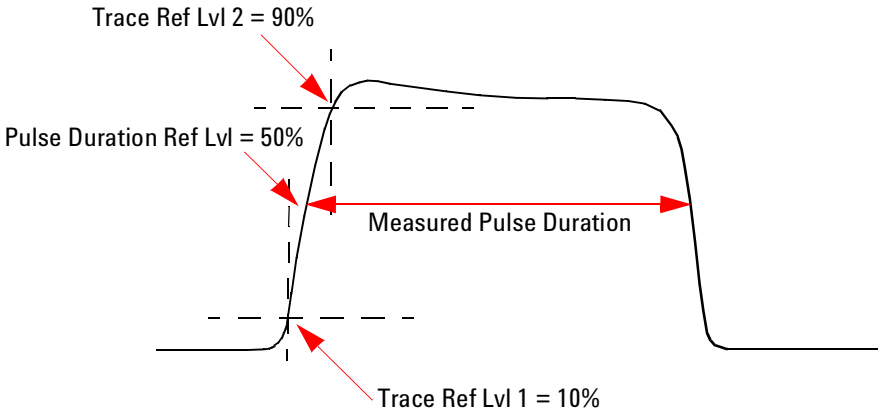



**Figure 2-5** Pulse duration measurement between two reference levels

1 Use the ▲ and ▼ softkeys to highlight the **Trace Ref Lvl 1** field.

2 Click SELECT to display the **Trace Ref Lvl 1** pop- up, and use the numeric softkey pad to enter the intended value in the **Trace Ref Lvl 1** pop- up window.

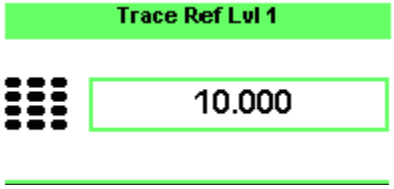



**Figure 2-6** Trace Ref Lvl 1 pop-up

3 Complete the entry by clicking the % softkey.

4 Use the ▲ and ▼ softkeys to highlight the **Trace Ref Lvl 2** field.

5 Click SELECT to display the **Trace Ref Lvl 2** pop- up, and use the numeric softkey pad to enter the intended value in the **Trace Ref Lvl 2** pop- up window.

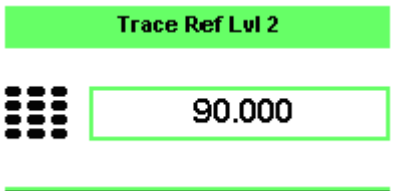



**Figure 2-7** Trace Ref Lvl 2 pop-up

6 Complete the entry by clicking the % softkey.

7 Use the ▲ and ▼ softkeys to highlight the **Pulse Duration Ref Lvl** field.

8 Click SELECT to display the **Pulse Duration Ref Lvl** pop- up, and use the numeric softkey pad to enter the intended value in the **Pulse Duration Ref Lvl** pop- up.

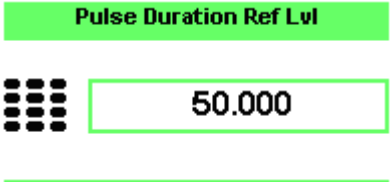



**Figure 2-8** Pulse Duration Ref Lvl pop-up

9 Complete the entry by clicking the % softkey.

**NOTE** By default, the **Trace Ref Lvl 1**, **Trace Ref Lvl 2** and **Pulse Duration Ref Lvl** settings are set to 10 %, 90 % and 50 % respectively.

**NOTE** Alternatively, you may use keyboard to enter the intended value when the desired field is highlighted.

# Setting Offsets

The power meter can be configured to compensate for a signal loss or gain in your test setup. The power meter allows you to apply offsets at three different points in the measurement path.

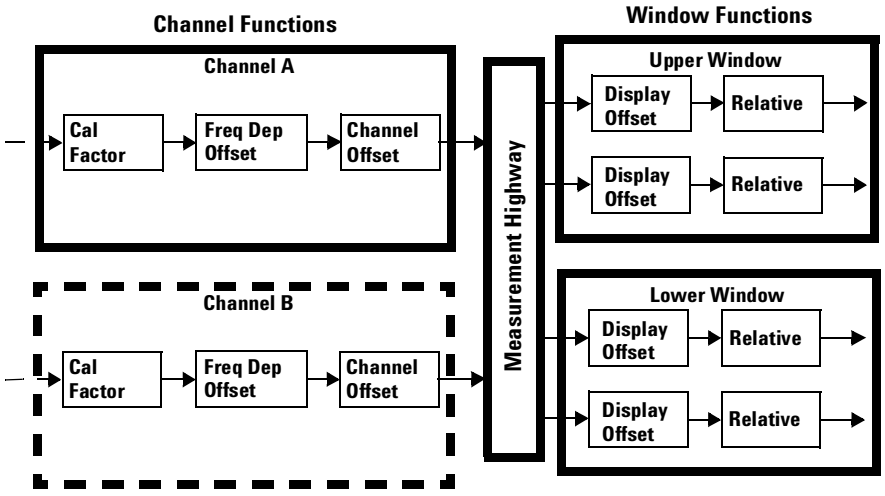



**Figure 2-9** Simplified measurement path

Figure 2-9 shows that how you can apply a **Channel Offset** or a **Frequency Dependent Offset** prior to any mathematical functions. These allow you to compensate each channel individually. An overall offset can be applied if required using the **Display Offset**.

## Setting Channel Offsets

This gain or loss is applied to the measured power before any mathematical functions, display offsets or relative functions are included.

Offsets are entered in dB and the range is –100 dB to +100 dB.

A positive value compensates for a loss and a negative value compensates for a gain.

### Procedure

To enter a channel offset:

1 Click F2 Channel to display the **Channel Setup** screen. Confirm the channel requiring setup is displayed.

2 Click **Offsets** to display the **Offsets Setup**.

3 Use the ▲ and ▼ softkeys to highlight the **Offset** setting field.

4 Click SELECT to check the **Offset** setting field.

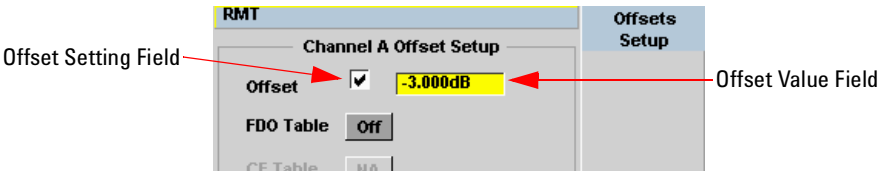



**Figure 2-10** Typical channel offset display

5 Click ▶ to highlight the **Offset** value field and click SELECT to display the **Offset** pop- up. Use the numeric softkey pad to enter the required value in the **Offset** pop- up window.

6 Confirm your choice by clicking **dB**.

7 Click Prev/Esc softkey to complete the offset entry. If either a channel or a display offset is set, the **Ofs** indicator is displayed.

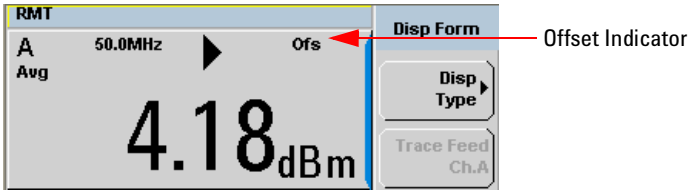



**Figure 2-11** Channel offset indicator

**NOTE** The **Ofs** symbol is not displayed when the associated measurement is displayed in Dual Numeric or Analog format.

## Setting Display Offsets

This gain or loss is applied to the measured power after any channel offsets or mathematical functions have been included.

Offsets are entered in dB and the range of values is –100 dB to +100 dB. A positive value compensates for a loss, and a negative value compensates for a gain.

### Procedure

Enter a display offset on the currently selected window:

1 Click F4 Meas to display the **Measurement Setup** screen.

2 Select the window you wish to set the offset value on by clicking the Meas Select softkey. The currently selected window/measurement is displayed.

3 Use the ▲ and ▼ softkeys to highlight the **Offset** setting field.

4 Click SELECT to check the **Offset** setting field.

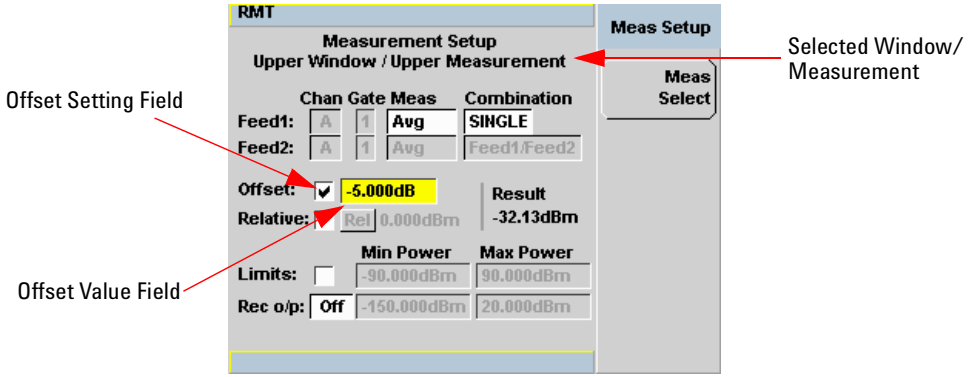



**Figure 2-12** Typical display offset display

5 Click ◉ to highlight the **Offset** value field and click SELECT to display the **Display Offset** pop- up. Use the numeric softkey pad to enter the required value in the **Offset** pop- up window.

6 Confirm your choice by clicking **dB**. Click Prev/Esc softkey to complete the offset entry.

**NOTE** The **Ofs** indicator is displayed if Display Offset is selected.

## Setting Frequency Dependent Offsets

Frequency dependent offset tables provide a quick and convenient method of compensating for frequency related changes in the response of your test system. Note that when selected, frequency dependent offset corrections are applied IN ADDITION to any correction for sensor frequency response.

The power meter is capable of storing 10 frequency dependent offset tables with a maximum of 80 frequency points each.

To use frequency dependent offset tables:

1 Select the table to be applied to a channel. Refer to "Setting Frequency Dependent Offsets" on page 44 for further information. If you require to edit the table refer to "Editing Frequency Dependent Offset Tables" on page 47 for further information.

2 If using an 8480 Series or an E- Series Sensor, zero and calibrate the power meter. The reference calibration factor used during the calibration is automatically set by the power meter from the sensor calibration table (if selected).

3 Specify the frequency of the signal you want to measure. The calibration factor/offset is automatically set by the power meter from the sensor calibration table (if selected) and the frequency dependent offset table. Refer to "Procedure" on page 46 for further information.

4 Make the measurement.

### Selecting a Frequency Dependent Offset Table

You can select a frequency dependent offset table from the F1 System softkey menu followed by **Tables** and **Freq. Dep. Offset**.

The State column indicates if any frequency dependent offset tables are currently selected. The **Offset Tables** screen is shown in Figure 2- 13.

**NOTE**

You can also view which FDO table is being used by clicking the F2 Channel, **Offsets** and use the ▲ and ▼ softkeys to highlight the **FDO Table** setting field and click SELECT to display the table.

### Procedure

Select an offset table as follows:

1 Click, either:

a. F1 System , **Tables** , **Freq. Dep. Offset** .

b. F2 Channel , **Offsets** and use the ⬆ and ⬇ softkeys to highlight the **FDO Table** setting field and click SELECT to display the table.

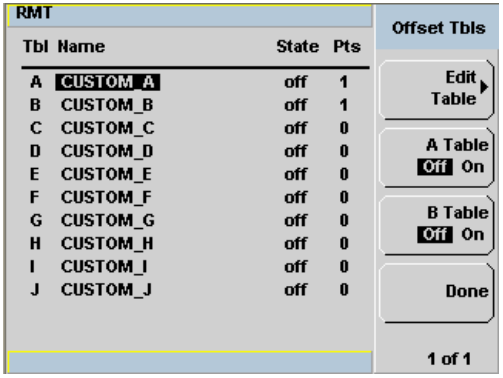



**Figure 2-13** Frequency Dependent Offset tables display

2 Use the ⬆ and ⬇ softkeys to highlight one of the 10 table titles and click **Table** to highlight **On** .

**NOTE** When no data is contained in the highlighted table, the **Table** softkey is disabled (grayed out).

3 Click **Done** to complete the selection of the offset table.

4 Click **Done** again to display the measurement screen. Figure 2- 14 shows which offset table is selected.

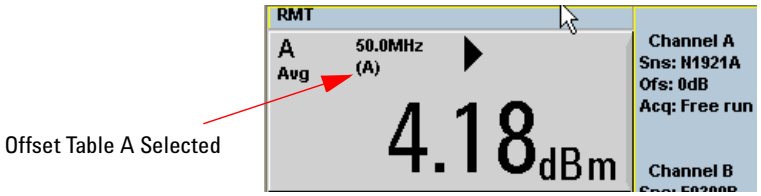



**Figure 2-14** Frequency dependent offset indicator

5 To change the frequency, click F2 Channel and use the ▲ and ▼ softkeys to highlight the **Frequency** field.

6 Click SELECT to display the **Frequency** pop-up window. Use the numeric softkey pad to enter the required value in the **Frequency** pop-up window.

7 To confirm your choice, click the appropriate unit softkey.

8 Connect the power sensor to the signal to be measured.

9 The measurement result, including offset, is now displayed.

**NOTE**

If the measurement frequency does not correspond directly to a frequency in the sensor calibration table (if selected) and the frequency dependent offset table being used, the power meter calculates the calibration factor and offset using linear interpolation.
If you enter a frequency outside the frequency range defined in the sensor calibration table or the frequency dependent offset table, the power meter uses the highest or lowest frequency point in the appropriate table to set the calibration factor and offset.

## Editing Frequency Dependent Offset Tables

There are ten frequency dependent offset tables named **CUSTOM_A** through **CUSTOM_J**. They are empty of any data when the power meter is shipped from the factory.

You cannot delete any of the 10 existing frequency dependent offset tables or create any additional tables. However, you can enter values into the 10 existing tables. Each frequency dependent offset table can contain a maximum of 80 frequency points.

To view the frequency dependent offset tables currently stored in the power meter, click F1 System, Tables, Freq. Dep. Offset. The **Frequency Dependent Offset Tables** screen is displayed as shown in Figure 2- 13.

Editing frequency dependent offset tables requires the following steps:

1 Identify and select the table you want to edit
2 Rename the table
3 Enter the frequency and offset pairs
4 Save the table

### Procedure

First select the table you want to edit as follows:

**NOTE** A frequency in the range of 0.001 MHz to 1000.0 GHz can be entered. A calibration factor in the range of 1 % to 150 % can be entered.

1 Click F1 System, Tables, Freq. Dep. Offset to display the **Offset Tbls** screen.
2 Choose the table you want to edit using the ▲ and ▼ softkeys. Click Edit Table to display the **Edit Offset** screen as shown in Figure 2- 15.

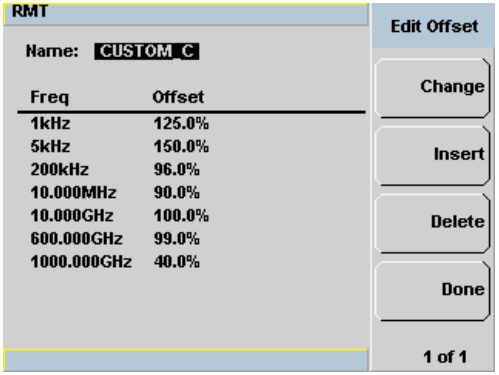



**Figure 2-15** "Edit Offset" display with data added

3 Highlight the table title using the and softkeys. Click **Change** and use the , , and softkeys to select and change the characters in the **Table Name** pop- up to create the name you want to use.

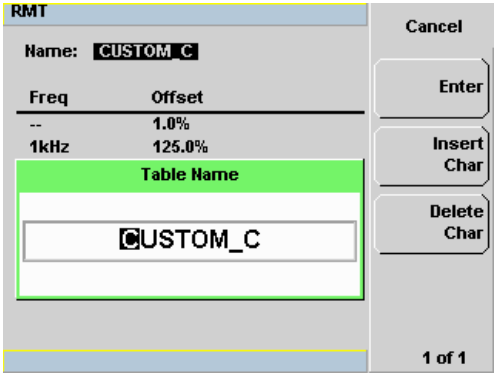



**Figure 2-16** Edit table title pop-up

- Clicking **Insert Char** adds a new character to the right of the selected character.
- Clicking **Delete Char** removes the selected character.

4 Click **Enter** to complete the entry.

**NOTE**

The following rules apply to naming sensor calibration tables:

- The name must consist of no more than 12 characters.
- All characters must be upper or lower case alphabetic characters, or numeric (0-9), or an underscore (_).
- No other characters are allowed.
- No spaces are allowed in the name.

Enter (or edit) the frequency and offset pairs as follows:

1. Click **Insert** to add a new frequency value (or click **Change** to edit). Use the numeric softkey pad to enter the required value in the **Frequency** pop- up window. Complete the entry by clicking the **GHz**, **MHz** softkeys.
2. Enter the new offset value (or click **Change** to edit). Use the numeric softkey pad to enter the required value in the Offset pop- up window. Complete the entry by pressing the **%** softkey.
3. Continue adding/editing values until you have entered all the data you require.
4. When you have finished editing the table click **Done** to save the table.

**NOTE** If you measure a signal with a frequency outside the frequency range defined in the frequency dependent offset table, the power meter uses the highest or lowest frequency point in the frequency dependent offset table to calculate the offset

# Setting Measurement Averaging

The power meter uses a digital filter to average power readings. The number of readings averaged can range from 1 to 1024. This filter is used to reduce noise, obtain the desired resolution and to reduce the jitter in the measurement results. Increasing the value of the measurement average reduces measurement noise. However, the measurement time is increased. You can manually select the measurement average or you can set the power meter to auto measurement average mode. The default is **AUTO**.

When the auto measurement average mode is enabled, the power meter automatically sets the number of readings averaged together to satisfy the filtering requirements for most power measurements. The number of readings averaged together depends on the resolution setting and the power level currently being measured.

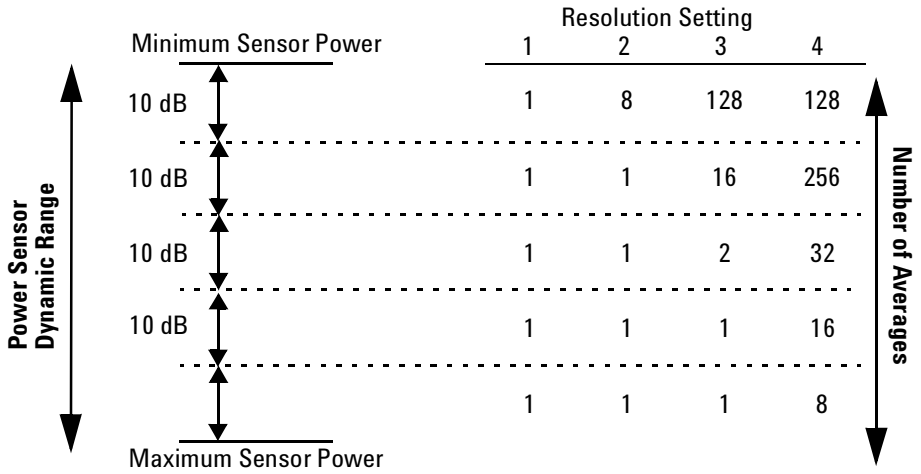



**Figure 2-17** Typical averaged readings

Figure 2- 17 shows the typical number of averages for each range and resolution when the power meter is in auto filter mode and is set to normal speed mode. P- Series Modular Power Meters recognize different sensor types when they are connected, and configure suitable averaging automatically.

Resolution is a measurement display function and not a channel function. In the case where a channel is set up in both the upper and lower window and the resolution settings are different, the highest resolution setting is taken to calculate the averaging number.

These four resolution levels represent:

- 1, 0.1, 0.01, 0.001 dB respectively if the measurement suffix is dBm or dB.
- 1, 2, 3 or 4 significant digits respectively if the measurement suffix is W or %.

### Procedure

Set measurement averaging as follows:

1 Click F2 Channel. Click **Channel** to select the required channel. The current setting is shown in the Meas Avg field (**AUTO**, **MAN**, or **OFF**) on the **Channel Setup** screen. The default is **AUTO**.

2 Use the ▲ and ▼ softkeys to select the Filter setting field.

3 Click SELECT and use the ▲ and ▼ to step through the available settings.

If you have selected **AUTO** or **OFF** proceed at step 7. If you have selected **MAN** proceed as follows:

4 Use the ▶ softkey to select the **Meas Avg:** value field.

5 Click SELECT to display the **Meas Avg Count** pop- up.

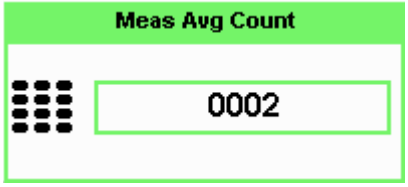



**Figure 2-18** Meas Avg Count pop-up

6 Use the numeric softkey pad to enter the required value and click **Enter**.

7 Click Prev/Esc softkey to close the **Channel Setup** screen.

# Step Detection

To reduce the filter settling time after a significant step in the measured power the filter can be set to re- initialize upon detection of a step increase or decrease in the measured power. Step detection can be set in both manual and automatic measurement average modes.

### Procedure

Set step detection as follows:

1 Click F2 Channel. Click **Channel** to select the required channel.

2 Use the ▲ and ▼ softkeys to select the **Step Detect** setting field.

3 Click SELECT to check the step detection to on or off.

4 Click Prev/Esc softkey to close the **Channel Setup** screen.

# Setting the Video Averaging

**NOTE** This feature is only available when a P-Series Power Sensor is connected.

Video averaging uses a digital filter to average repetitions of a triggered signal. The number of acquisitions averaged can range from 1 to 256, in multiples of $2^n$. With video averaging the average of a number of acquisitions is calculated to smooth the displayed trace and reduce apparent noise. The measurement requires a continuously repeating signal. Increasing the value of this filter reduces noise but increases the time required to make the measurement.

### Procedure

Set the video average as follows:

1 Click F2 Channel. Click **Channel** to select the required channel.

2 Use the ▲ and ▼ softkeys to select the **Video Avg** setting field.

3 Click SELECT to check the video averaging to on or off.

4 Use the ▶ softkey to select the **Video Avg:** value field.

5 Click SELECT to display the **Video Avg Count** pop- up.

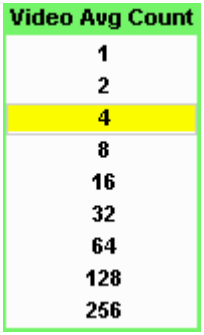



**Figure 2-19** Video Avg Count pop-up

6 Use the ⬆ and ⬇ softkeys to highlight the required **Video Avg Count** value and click SELECT.

7 Click Prev/Esc softkey to close the **Channel Setup** screen.

# Setting the Video Bandwidth

**NOTE** This feature is only available when a P-Series Power Sensor is connected.

Selecting a bandwidth value close to or slightly greater than required by the modulating signal bandwidth can help reduce noise and improve accuracy on peak measurements (see Table 2- 3). It can however, reduce the processing speed for long acquisition times.

**Table 2-3** P-Series Sensor Video Bandwidth Setting

| Low: | Medium: | High: | Off |
|---|---|---|---|
| 5.0 MHz | 15.0 MHz | 30.0 MHz | >30.0 MHz |

The Low, Medium, and High pass band shapes achieved by the video bandwidth settings provide flat filter responses with very sharp cut- off points by applying digital signal processing techniques to ensure accurate power measurement within the specified band.

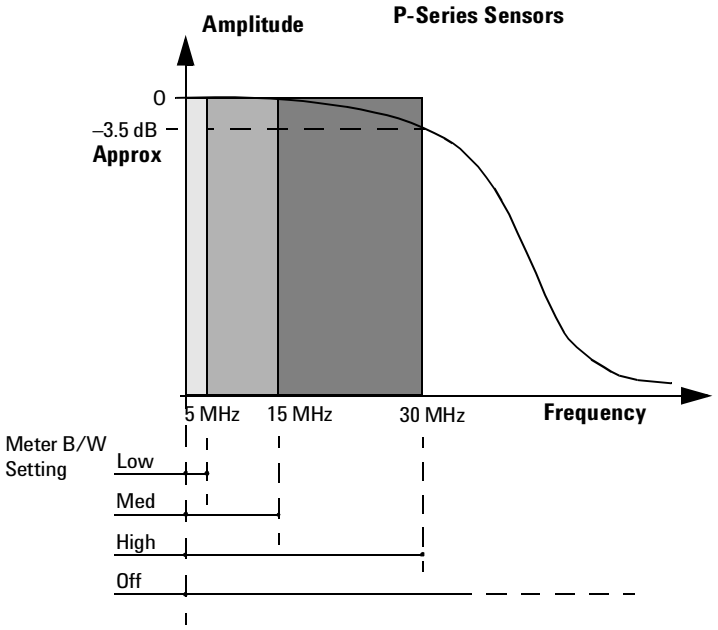



**Figure 2-20** Bandwidth filter shapes

When video bandwidth is set to Off, it removes all digital signal conditioning. This provides approximately 3 dB roll off at the maximum sensor's bandwidth and is best suited for accurate trace capture, minimizing overshoot, and removing any ringing effects caused by the sharp cut- off filters used in the Low, Med and High settings. Figure 2- 20 shows the filter shapes associated with the P- Series Wideband Power Sensors.

### Procedure

Set the video bandwidth as follows:

1 Click F2 Channel. Click **Channel** to select the required channel.

2 Use the ▲ and ▼ softkeys to select the **Video B/W** setting field.

3 Click SELECT to display the **Video B/W** pop- up.

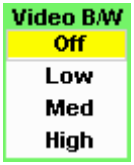



**Figure 2-21** Video Bandwidth pop-up

4 Use the ⬆ and ⬇ softkeys to highlight the required **Video Bandwidth** setting and click SELECT.

5 Click Prev/Esc softkey to close the **Channel Setup** screen.

# Setting Measurement Channel Gates

**NOTE** This feature is only available when a P-Series Power Sensor is connected.

A system of gates, controlled by and referenced to a trigger point, is used to obtain measurement data from a captured trace. The trace data within each gate period is subsequently used for the individual measurement calculations. Up to 4 gates can be set up for each channel. Figure 2- 22 shows an example of 4 gates setup to perform the following measurements simultaneously:

- Average power level of the pulse:

  Gate 1, average measurement
- Average “off” power level ahead of the pulse:

  Gate 2, average measurement
- Peak to average ratio:

  Gate 1, peak- to- average measurement
- Pulse drop:

  Gate 3, average measurement, minus Gate 4, average measurement

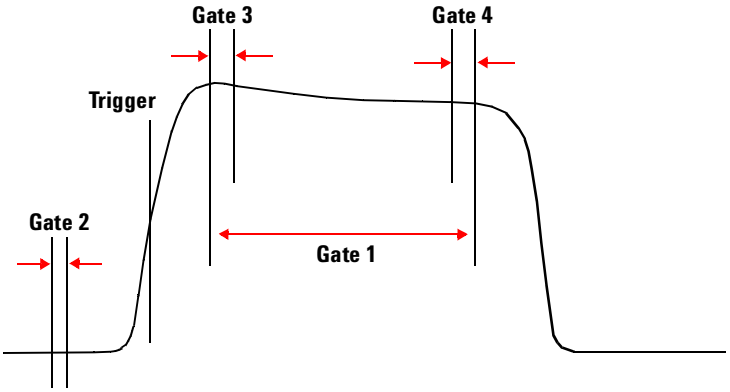



**Figure 2-22** Example of measurement gates

**NOTE** Figure 2-22 shows measurement results using this example of the gates placement.

### Procedure

**NOTE** This procedure uses the **Gates Setup** under the **Channel Setup** menu. Alternatively, you can use a more visual method, when in the Graphical Trace Mode (Gate Control Menu), to set the channel's Gate Control. (See "Setting the Trace Display" on page 100).

- Click **Gates Setup** . The **Channel Gate Setup** screen is displayed.

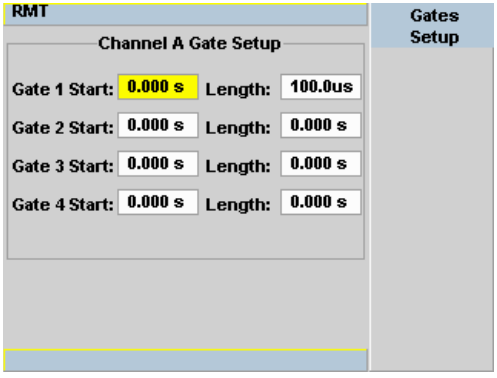



**Figure 2-23** Gate Setup screen

1 Highlight the **Gate Start** you want to configure using the ◀, ▶, ▲ and ▼ softkeys.

**NOTE** The gate start time is relative to the trigger event. Positive values set a measurement gate, to a maximum time of 1 second, after the trigger. Negative time gate start values set a measurement gate, to a maximum time of 1 second, before the trigger.

2 Click SELECT and use the numeric softkey pad to enter the required value in the **Time Gating Start** pop- up window.


**Figure 2-24** Time Gating Start pop-up

3 Complete the entry by clicking the required second, millisecond, microsecond or nanosecond ( s , ms , us or ns ) softkey.

4 Highlight the **Gate Length** you want to configure using the ◀, ▶, ▲, and ▼ softkeys.

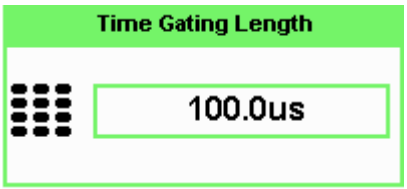



**Figure 2-25** Time Gating Length pop-up

5 Complete the entry by clicking the required second, millisecond, or microsecond or nanosecond ( s , ms , us or ns ) softkey.

6 Repeat this process until you have setup all the required gates.

# Setting up the Channel Trace

**NOTE** This feature is only available when a P-Series Power Sensor is connected.

**NOTE** The **Trace Setup** is the only location where you can change the Y-axis units from **dBm** to **Watts**.

### Procedure

**NOTE** This procedure uses the **Trace Setup** under the **Channel Setup** menu. Alternatively, you can use a more visual method, when in the Graphical Trace Mode (Trace Control Menu), to set the channel's Trace Control. (See "Setting the Trace Display" on page 102).

1 Click F2 Channel, Trace Setup to display the **Trace Setup** menu.

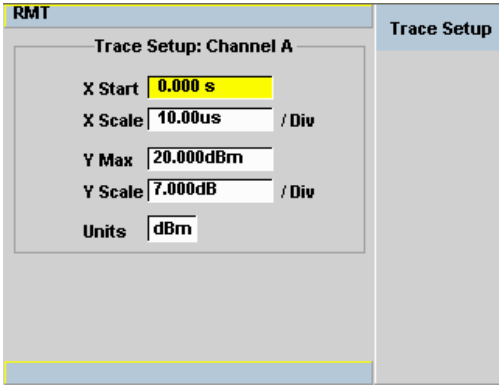



**Figure 2-26** Trace setup display

2 Use the ▲ and ▼ softkeys to highlight the **X Start** field.

3 Click SELECT to display the **Trace Start Time** pop- up and use the numeric softkey pad to enter the required value in the **Trace Start Time** pop- up window.

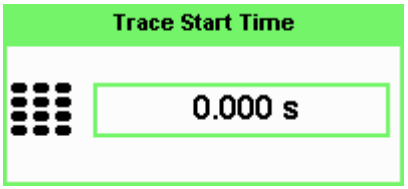



**Figure 2-27** Trace Start Time pop-up

4 Complete the entry by clicking the required second, millisecond, microsecond or nanosecond (**s** , **ms** , **us** or **ns** ) softkey.

5 Use the ▲ and ▼ softkeys to highlight the **X Scale** field.

6 Click SELECT to display the **X Scale/Division** pop- up.

a. Use the numeric softkey pad to enter the required value in the **X Scale/Division** pop- up window.

b. Use the ▲ and ▼ softkeys to increase or decrease the value.

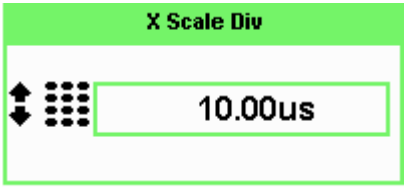



**Figure 2-28** X Scale/Division pop-up

7 Complete the entry by clicking:

a. The required second, millisecond, microsecond or nanosecond (**s** , **ms** , **us** or **ns** ) softkey.

b. The **Enter** softkey.

8 Use the ▲ and ▼ softkeys to highlight the **Units** field.

If you want to view the trace in linear scale, use this field. Otherwise the default scale is in logarithmic.

9 Click SELECT to display the Units pop- up, and use the ▲ and ▼ to highlight **Watt** or **dBm**.

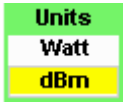



**Figure 2-29** Trace Units pop-up

10 Click SELECT to complete the entry.

11 Use the ▲ and ▼ softkeys to highlight the **Y Max** field.

12 Click SELECT to display the **Trace Maximum** pop- up, and use the numeric softkey pad to enter the required value in the **Trace Maximum** pop- up window.

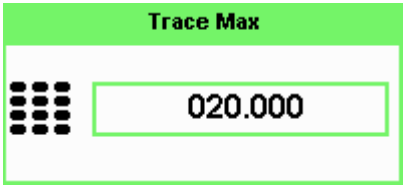



**Figure 2-30** Y scale maximum value pop-up

13 Complete the entry by clicking the **dBm** or the linear value.

14 Use the ▲ and ▼ softkeys to highlight the **Y Scale** field.

15 Click SELECT to display the **Y Scale/Division** pop- up.

a. Use the numeric softkey pad to enter the required value in the **Y Scale/Division** pop- up window.

b. Use the ▲ and ▼ softkeys to increase or decrease the value.

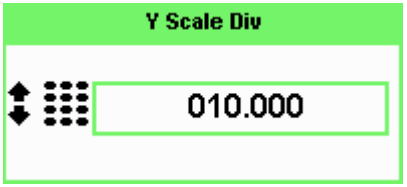



**Figure 2-31** Y Scale/Division pop-up

**16** Complete the entry by clicking the **dB** or the linear value.

**17** Click Prev/Esc softkey to complete the setup and display the measurements results.

# Setting the Trigger

**NOTE** This feature is only available when a P-Series Power Sensor is connected.

The trigger can be taken from a rising or falling measured power level or controlled externally using the Ext Trig input. Additional control features such as; hold- off, hysteresis, and delay are provided to help you achieve a stable and reliable trigger. To use the measurement gates, the power meter must be triggered.

- Press F3 Trig/Acq. **The Trigger** menu is displayed.

The trigger status is displayed below the **Acqn** label in the **Trigger** menu. Figure 2- 32 shows the power meter display in **Free Run** mode. In this mode the meter is not synchronized to any modulated RF signal at the sensor input. Consequently, power levels within the configured time gates are random and the displayed measurement results are not valid.

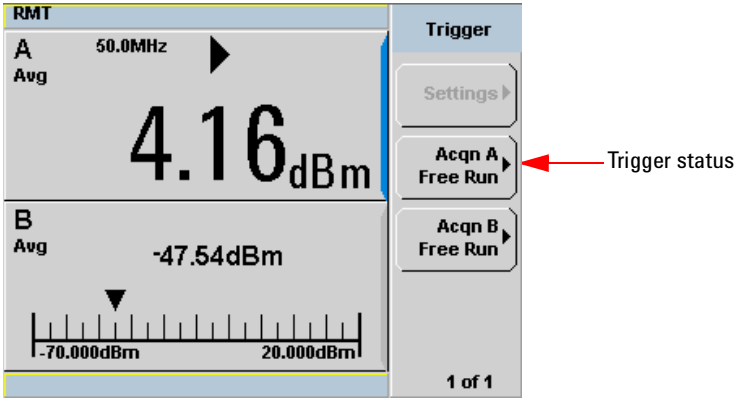



**Figure 2-32** Trigger menu - free run mode

**NOTE** The symbol ▶ in the upper window indicates the power meter is in free mode.

### Procedure

1 Click **Acqn A** or **Acqn B** softkeys to configure a trigger.

2 Select either **Sing Trig** or **Cont Trig**.

- **Sing Trig** is a single shot mode. After triggering, the measurement is halted, the ⊗ symbol is displayed. You can start another measurement by clicking the F6 Run/Stop softkey.
- **Cont Trig** is a continuos trigger mode. The symbol ↴ or ↱ is displayed.

3 Click **Settings** to configure the remaining trigger parameters. The trigger Settings menu have 2 pages. Figure 2-33 shows page 1 and Figure 2-36 shows page 2.

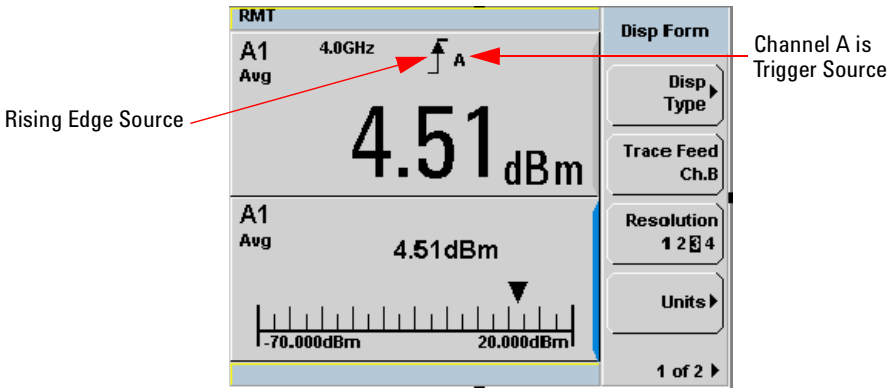



**Figure 2-33** Trigger Setting Menu 1 of 2

To help you quickly check the triggering setup, the current settings for all the trigger parameters are shown with their respective softkey labels.

**Source** The current setting is shown below the **Source** label.

To change the setting press **Source** and choose **Ext**, **Ch.A** or **Ch.B**.

The trigger source is shown beside the trigger symbol when a measurement window is configured in single numeric mode. When an external trigger (**Ext**) is selected, the power meter can be triggered via the Ext Trig input.

**Mode** The **Mode** key is only available when trigger **Source Ch.A** or **Source Ch.B** is selected.

To change the setting press **Mode** and choose **Norm** or **AutoLvl**.

The current setting is displayed below the label. When **Norm** is selected you can choose the RF power level transition used as the trigger. The power meter automatically finds a triggering power level transition when **AutoLvl** is selected.

**Level** **Level** is only available when **Norm** trigger mode has been selected. The current value is shown below the **Level** label. The minimum power level you can enter is limited to 40 dB below the maximum sensor power. To change the setting press **Level** and use the numeric softkey pad to enter the required value in the **Trigger Level** pop- up window to enter the new value.

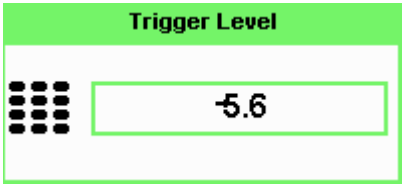



**Figure 2-34** Trigger Level pop-up

Complete the entry by pressing **dBm**.

**Delay** The current setting is displayed below the **Delay** label. The delay time is applied between the trigger event and all the gate start times. This allows you to time- shift all the gates by the same amount with one setting change. A delay of up to 1 second can be entered. To enter or change the setting press **Delay** and use the numeric softkey pad to enter the required value in the **Trigger Delay** pop- up window to enter the new value.

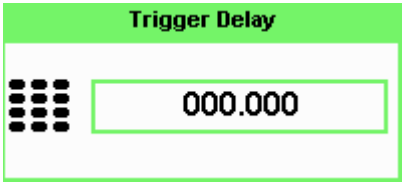



**Figure 2-35** Trigger delay pop-up

Complete the entry by pressing the required second, millisecond, microsecond or nanosecond (**s**, **ms**, **us** or **ns**) softkey.

**NOTE** The trigger delay time can also be entered or changed in the Trace Display mode when the **Gate Control** menu is displayed. See "Setting the Trace Display" on page 100 for further detail.

Click **1 of 2** to display the second menu page.

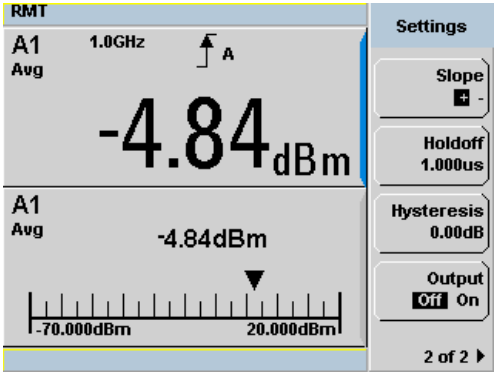



**Figure 2-36** Trigger setting menu 2 of 2

**Slope** The current setting is displayed below the **Slope** label and the ↓ or ↑ symbol is displayed in single numeric display mode. **+** (and ↑) is used to generate the trigger from an increasing power level. Similarly, **–** (and ↓) is used to generate the trigger from a decreasing power level. To change the setting, press **Slope** to highlight **+** or **–** as required.

**Holdoff** The current setting is displayed below the **Holdoff** label. After a trigger event occurs, the trigger mechanism is disabled for the configured time period. This allows stable triggering to be achieved even when a signal has multiple edges, for example, a TDMA signal with non- constant amplitude modulation. Values up to 400 ms can be configured.

To change the setting press **Holdoff** and use the numeric softkey pad to enter the required value in the **Trigger Holdoff** pop- up window to enter the new value.

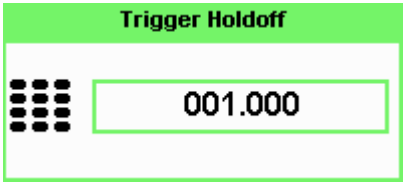



**Figure 2-37** Trigger holdoff pop-up

Complete the entry by pressing **ms**, **us** or **ns**.

**Hysteresis** **Hysteresis** is only available when **Norm** trigger mode has been selected. The current setting is displayed below the **Hysteresis** label. You can use the hysteresis function to help generate a more stable trigger by preventing triggering unless the RF power level achieves the trigger level and the additional hysteresis value. It can be applied to both rising and falling edge trigger generation. A maximum of 3 dB hysteresis can be entered.

### Rising Edge

When a rising power transition triggers the power meter, the triggering system is disabled. The power meter does not trigger again if another rising power transition is presented. The triggering system is re- armed only when the input power falls below a level equal to the trigger level minus the configured hysteresis value.

### Falling Edge

When a falling power transition triggers the power meter, the triggering system is disabled. The power meter does not trigger again if another falling power transition is presented. The triggering system is rearmed only when the input power rises above a level equal to the trigger level plus the configured hysteresis value.

To change the setting, press **Hysteresis** and use the numeric softkey pad to enter the required value in the **Trigger Hysteresis** pop- up window to enter the new value.

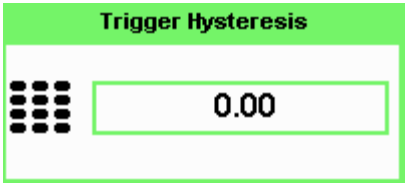



**Figure 2-38** Trigger hsyteresis pop-up

Complete the entry by pressing **dB**.

**Output** The current setting is displayed below the **Output** label. A TTL level high is produced at the front panel **TRIG OUT** SMB connector when the power meter is triggered when **On** is configured.

To change the setting, click **Output** to highlight **On** or **Off** as required.

# Setting Measurement Limits

You can configure the power meter to detect when a measurement has crossed over a predefined upper and/or lower limit value.

Limits are boundaries set for a certain power range and it can be applied to power, ratio or difference measurement.

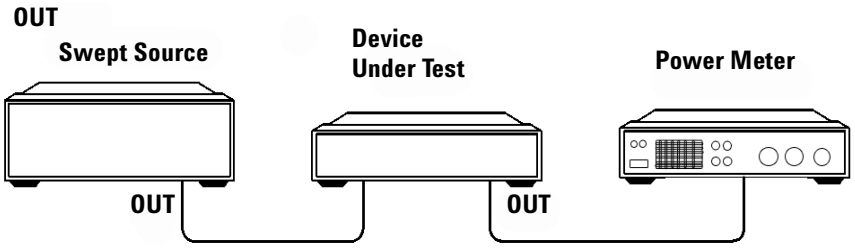



**Figure 2-39** Limits checking applications

In this application a swept frequency signal is applied to the input of the Device Under Test. The power meter measures the output power. The limits have been set at +4 dBm and +10 dBm. A fail occurs each time the output power is outside these limits as shown in Figure 2- 40.

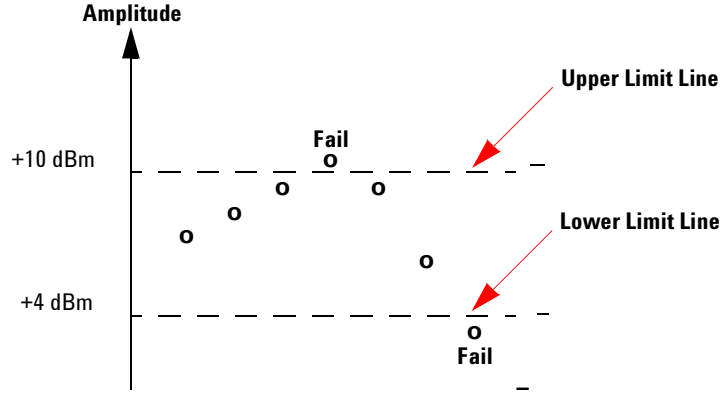



**Figure 2-40** Limits checking results

## Setting Limits

The power meter can be configured to verify the current measurement in any measurement line against predefined upper and/or lower limit values. The range of values that can be set for the upper and lower limits and the default values depends on the measurement units in the currently selected measurement line (see Table 2- 4).

**Table 2-4** Range of values for window limits

| Window Units | Maximum | Minimum | Default Maximum | Default Minimum |
|---|---|---|---|---|
| dB | +200 dB | –180 dB | 60 dB | –120 dB |
| dBm | +230 dBm | –150 dBm | 90 dBm | –90 dBm |
| % | 999.9 X% | 100.0 a% | 100.0 M% | 100.0 p% |
| W | 100.000 XW | 1.000 aW | 1.000 MW | 1.000 pW |

### Procedure

Set the limits as follows:

**NOTE** Ensure you have selected the channel you wish to set up.

1 Click F4 Meas, Meas Select to display the **Measurement Setup** menus.

2 Use the ▲ and ▼ softkeys to highlight the **Limits:** setting field.

3 Click SELECT to check the **Limits:** setting field.

4 Use the ▶ softkey to highlight the **Minimum Limits:** value field.

5 Click SELECT to display the **Minimum Limit** pop- up.

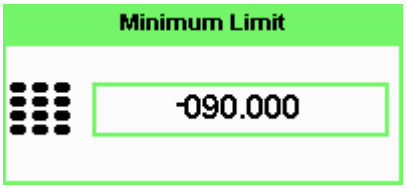



**Figure 2-41** Minimum limit pop-up

6 Use the numeric softkey pad to enter the required value and click **dBm**.

7 Use the ▶ softkey to highlight the **Maximum Limits:** value field.

8 Click SELECT to display the **Maximum Limit** pop- up.

9 Use the numeric softkey pad to enter the required value and click **dBm**.

10 Click Prev/Esc softkey to close the **Measurement Setup** screen.

**NOTE** The Limits can be disabled and re-enabled by checking the **Limits:** setting field.

## Checking for Limit Failures

Limit failures are displayed in the appropriate field in the measurement window on the power meter's display as shown in Figure 2- 42.

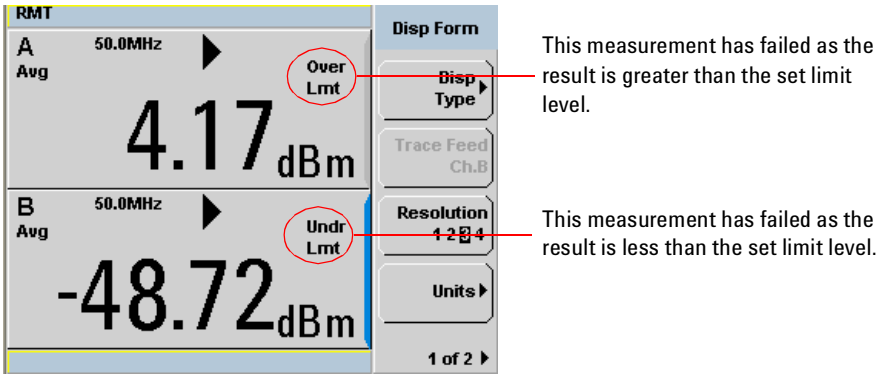



**Figure 2-42** Limit failures

# Setting the Measurement Display

Using the gate settings, up to four measurements or a combination of measurements can be shown on the display. Any of the 4 measurement display lines can show any of the measurement results from any of the 4 gates, allowing you complete control of the displayed information.

The power meter cannot display all 12 (or 24) measurements simultaneously.

Average, peak, and peak- to- average ratio are made within each gate period generating possible measurement results per channel as shown in Figure 2- 43.

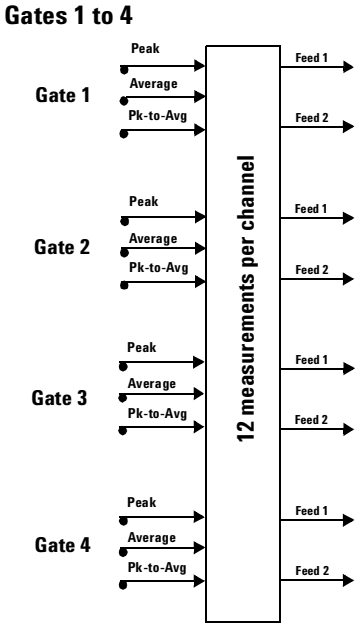



**Figure 2-43** Twelve measurements per channel

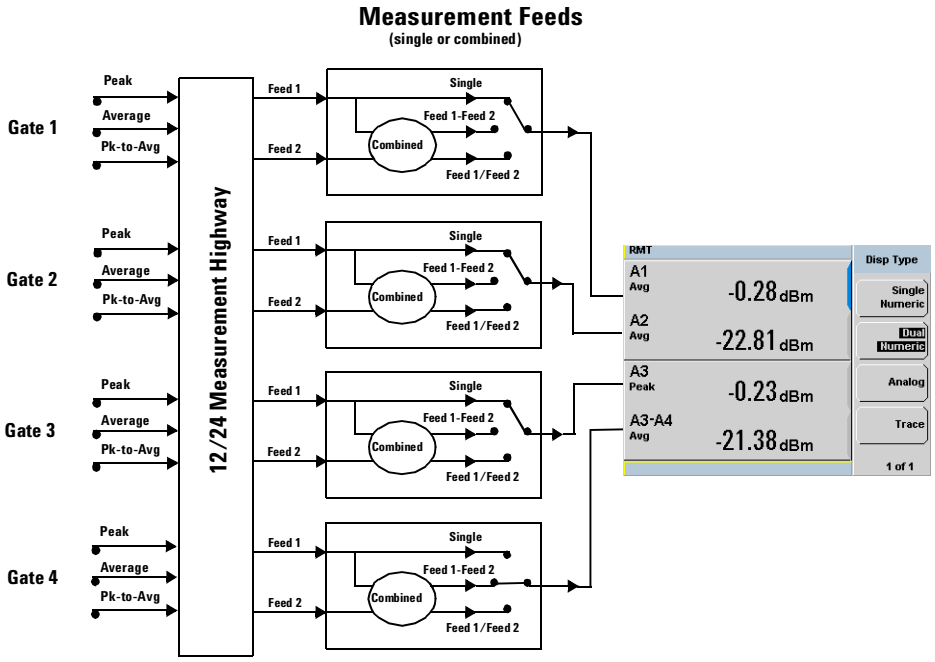



**Figure 2-44** Measurement feed example

Each displayed line has a measurement feed. Each measurement feed has two independent inputs, Feed 1 and Feed 2. The two Feeds, 1 and 2, can carry any of the 12 measurement results from the 4 gates. (24 measurements from 8 gates in the dual channel ). Only Feed 1 can be displayed in Single Mode. In Combined Mode, Feed 1 - Feed 2 or Feed 1 / Feed 2 can be displayed.

## Numeric Format

Configure a measurement displayed in **Single Numeric** or **Dual Numeric** format as follows:

- Click F4 Meas, Meas Select to select the measurement window or measurement line you want to configure.

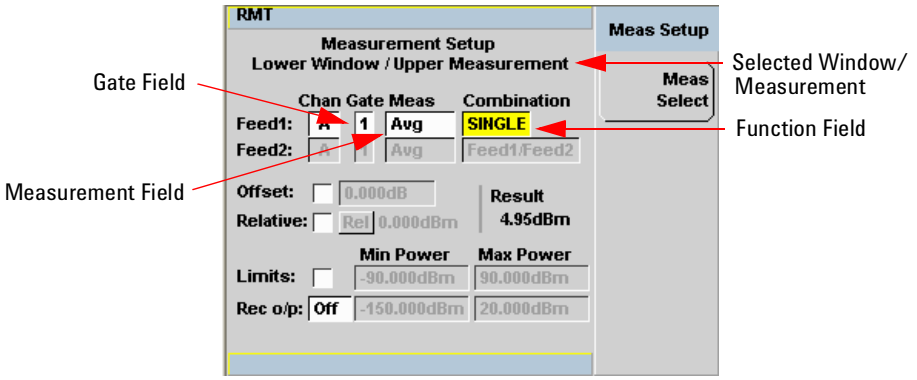



**Figure 2-45** Measurement Setup showing single configuration

## Single Function Measurement

Figure 2- 45 shows Gate 1 with an average measurement assigned in the upper measurement line of the lower window.

**NOTE** The gate field is disabled if trigger acquisition is Free Run.

1 Use the ◄, ►, ▲, ▼, to highlight the **Combination** function field.

2 Click SELECT to display the Function pop- up, and use the ▲ and ▼ to highlight **Single**.


**Figure 2-46** Function pop-up

3 Click SELECT to complete the entry.

4 Use the ◀, ▶, ▲, ▼, to highlight the measurement type field.

5 Click SELECT to display the **Feed Measurement** pop- up, and use the ▲ and ▼ in assign a measurement type.

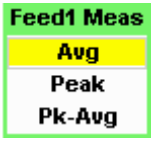



**Figure 2-47** Measurement type pop-up

6 Click SELECT to complete the entry.

7 Use the ◀, ▶, ▲, ▼, to highlight the **Gate** field.

8 Click SELECT to display the **Gate Number** pop- up, and use the numeric softkey pad to enter the required value in the **Gate Number** pop- up window.

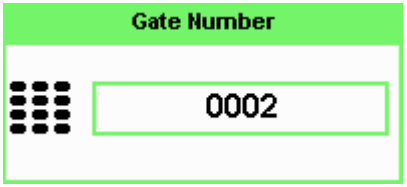



**Figure 2-48** Gating number pop-up

9 Click **Enter** to complete the entry.

10 Repeat this process until you have setup all the required gates and measurements.

11 Click Prev/Esc softkey to complete the setup and display the measurement results.

## Combined Measurement

Figure 2- 49 shows a Combined Measurement configuration; Channel A, gate 1 peak power minus gate 3 peak power, to be displayed in the lower measurement line of the lower display window.

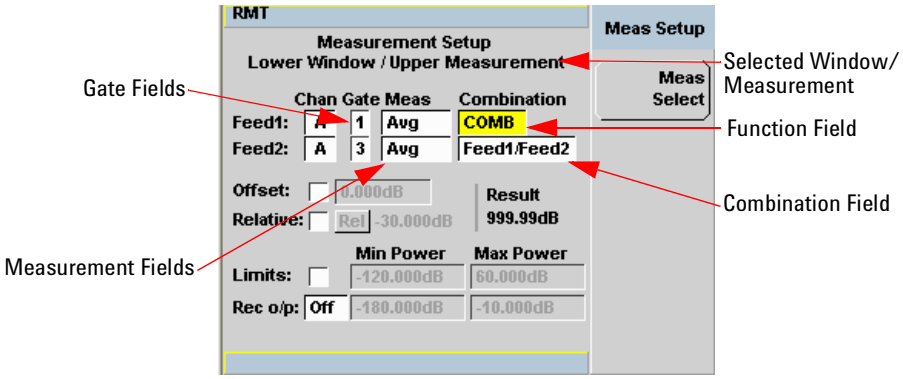



**Figure 2-49** Measurement Setup showing combined configuration

**NOTE** The **Gate** field is disabled if Trigger Acquisition is Free Run.

1 Use the ◀, ▶, ▲, ▼, to highlight the **Combination** function field.

2 Click SELECT to display the **Function** pop- up (see Figure 2- 46) and use the ▲ and ▼ to highlight **Combined**.

3 Click SELECT to complete the entry.

4 Use the ◀, ▶, ▲, ▼, to highlight the measurement type field.

5 Click SELECT to display the **Feed Measurement** pop- up (see Figure 2- 47) and use the ▲ and ▼ in assign a measurement type.

6 Click SELECT to complete the entry.

7 Use the ◄, ►, ▲, ▼, to highlight the **Gate** field.

8 Click SELECT to display the **Gate Number** pop- up, see Figure 2- 48, and use the numeric softkey pad to enter the required value in the **Gate Number** pop- up window.

9 Click Enter to complete the entry.

10 Repeat this process until you have setup all the required gates and measurements.

11 Click Prev/Esc softkey to complete the setup and display the measurements results.


**Figure 2-50** Measurement example display

# Scaling the Analog Display

**NOTE**

Ensure you have highlighted an Analog window.

Use the , , or softkeys to select the analog measurement window.

Click **dBm** , **mW** , **uW** , or **nW** , to complete the entry.

---

Configure a measurement displayed in **Analog** format as follows:

1 Click F5 Disp , **Anlg Mtr Scaling** to display the **Analog Scaling** softkeys.

The **Max** and **Min** scale values are shown on the analog display and adjacent to the softkey labels.

2 Click **Max** to display the **Meter Maximum** pop- up.

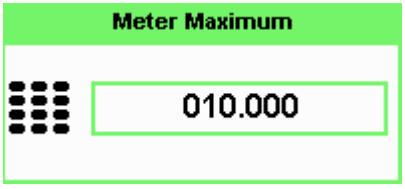



**Figure 2-51** Maximum limit pop-up

3 Use the numeric softkey pad to enter the required value and click **dB**.

4 Click **Min** to display the **Meter Minimum** pop- up.

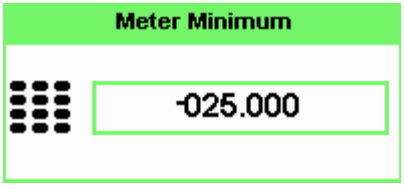



**Figure 2-52** Minimum limit pop-up

5 Use the numeric softkey pad to enter the required value and click **dB**.

**Tip** If you have selected linear scaling for the analog measurement and the units you require are beyond the range of the displayed menu, an additional menu is available. When the pop- up is displayed, you can press 1 of 2 to access the increment/decrement multiplier menu.

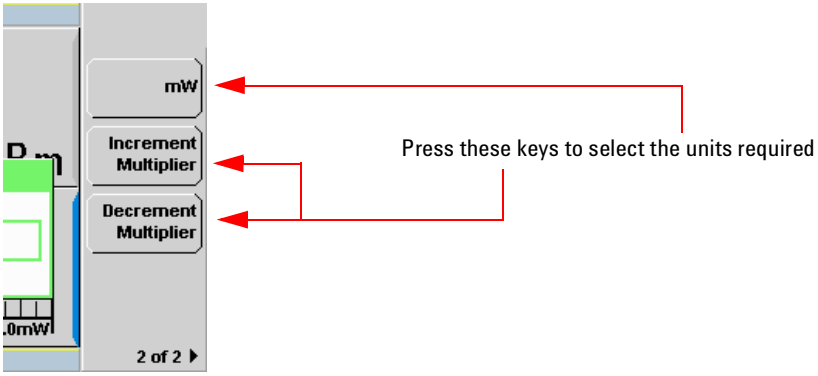



**Figure 2-53** Increment and decrement multiplier

Use the **Increment Multiplier** or **Decrement Multiplier** to display the required units.

Click the units softkey (**xW**) to complete the entry.

# Recorder Output

The front panel **Recorder Output** connectors (1 and 2) produce a dc voltage that corresponds to the power level in Watts of the channel depending on the measurement mode. This dc voltage ranges from 0 to +1 Vdc. The output impedance is typically 1 kΩ.. Channel and display offsets, and duty cycle have no effect on the Recorder Outputs.

For example, the Recorder Outputs can be used to:

- Record swept measurements
- Level an output from a source using external leveling
- Monitor the output power

To access the **Recorder** menu click F4 Meas, and enable Rec o/p. This allows you to switch the Recorder Output signal either on or off. The **Max Power** and **Min Power** softkeys allow you to scale the power levels to represent the 1 Vdc maximum and 0 Vdc minimum output voltage of the Recorder Output.

### Procedure

Set the recorder output as follows:

**NOTE** Ensure you have selected the channel you want to set up.

1 Click F4 Meas, **Meas Select** to display the **Measurement Setup** menus.

2 Use the ▲ and ▼ softkeys to highlight the **Rec o/p:** setting field.

3 Click SELECT to reveal the **Recorder** option menu.

4 Use the ▲ and ▼ softkeys to highlight the option you require.
   - Three options: 1, 2 or Off.

5 Click SELECT .

6 Use the ▶ softkey to highlight the **Recorder Minimum:** value field.

7 Click SELECT to display the **Recorder Minimum** pop- up.

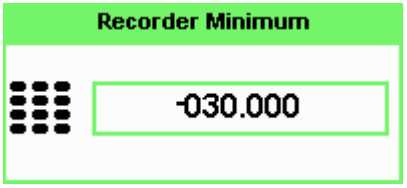



**Figure 2-54** Recorder minimum pop-up

8 Use the numeric softkey pad to enter the power level you want to generate a 1 Vdc output in the **Recorder Maximum** pop- up and click **dBm**.

9 Use the ▶ softkey to highlight the **Recorder Maximum:** value field.

10 Click SELECT to display the **Recorder Maximum** pop- up.

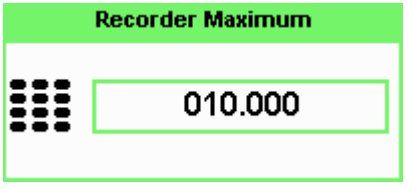



**Figure 2-55** Recorder minimum pop-up

11 Use the numeric softkey pad to enter the power level you want to generate a 0 Vdc output in the **Recorder Minimum** pop- up and click **dBm**.

12 Click Prev/Esc softkey to close the **Measurement Setup** screen.

**NOTE** The recorder output can be disabled and re-enabled by checking the **Rec o/p:** setting field.

**NOTE** The highest power you are going to measure is used to determine the value which you should set for the **Recorder Output** maximum setting. For example, if you are measuring a power less than 1 mW and greater than 100 mW, then set the recorder maximum value to 1 mW.

**Table 2-5** Ranges of recorder output setting

| **Log** | **50** | **40** | **30** | **20** | **10** | **0** |
|---|---|---|---|---|---|---|
| Lin | 100 W | 10 W | 1 W | 100 mW | 10 mW | 1 mW |

| **Log** | **–10** | **–20** | **–30** | **–40** | **–50** | **–60** |
|---|---|---|---|---|---|---|
| Lin | 100 mW | 10 mW | 1 mW | 100 nW | 10 nW | 1 nW |

**Tip** If you have selected linear scaling for the recorder output and the units you require are beyond the range of the displayed menu, an additional menu is available. When the pop- up is displayed, you can press 1 of 2 to access the increment/decrement multiplier menu.

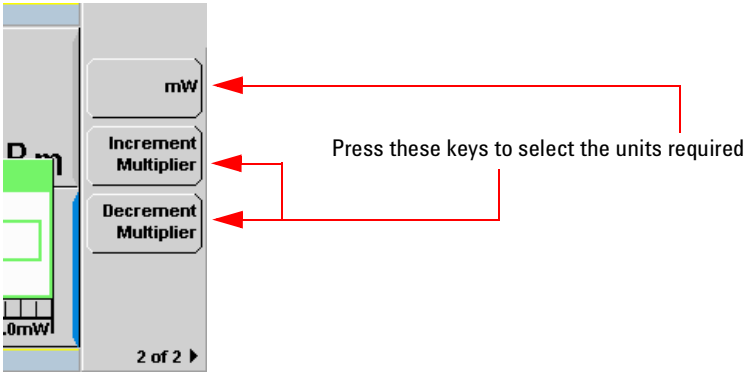



**Figure 2-56** Increment and decrement multiplier

Use the **Increment Multiplier** or **Decrement Multiplier** to display the required units. Click the units softkey (**xW**) to complete the entry.

# Saving and Recalling Power Meter States

To reduce repeated setup sequences, you can save a maximum of ten power meter states in the non-volatile memory.

The save/recall functions are part of the **Sys/Inputs** menu, accessed by clicking the F1 System softkey.

**NOTE** Your power meter has measurement configurations suitable for common wireless communication and radar (pulse) formats already saved as Instrument Presets. These require P-Series Power Sensors.

To save a measurement setup:

1 Click F1 System, Save/Recall to display the **Save/Recall** screen as shown in Figure 2-57.

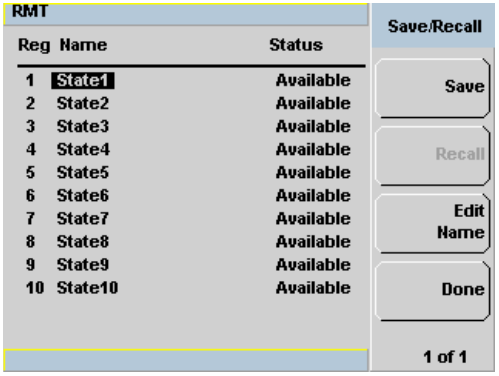



**Figure 2-57** Save/Recall screen

2 Using the ▲ and ▼ softkeys, select an available name from the displayed list. To change the name of a register - See Chapter 2, “Editing a Register’s Name,” starting on page 90, otherwise click Save.

3 The power meter prompts you to click Confirm to proceed.


**Figure 2-58** Save confirm pop-up

## Editing a Register's Name

1 If you have not already done so, click F1 System, **Save/Recall**.

2 Use the ▲ and ▼ softkeys to select the required register and click **Edit Name**. The selected name is displayed in a pop- up window. Modify this as required:

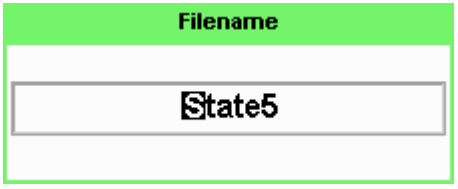



**Figure 2-59** File name pop-up

3 Use ▲ and ▼ softkeys to modify the character on which the cursor is currently positioned.

4 Use ◀ or ▶ to move to other characters.

5 Use **Insert Char** and **Delete Char** as required.

6 To confirm your choice click **Enter**.

## Recalling a Measurement Setup

1 Click F1 System, **Save/Recall**.

2 Use the ▲ and ▼ softkeys to select the required register and click **Recall**.

The **Recall** softkey is disabled (grayed out) when an unused register is selected.

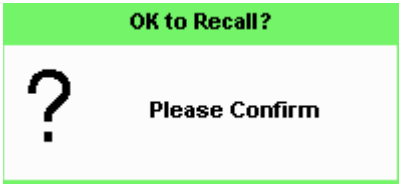



**Figure 2-60** Recall pop-up

**3** Click **Confirm**.

# Zeroing and Calibrating the P-Series Sensor

This section describes how to zero and calibrate the power meter when using a P- Series Wideband Power Sensor.

## Zeroing

Zeroing adjusts the power meter for a zero power reading on each power meter channel and P- Series sensor combination. This is achieved without removing it from a power source. The power meter can be set to automatically zero *on- the- fly* while you are using the it. Alternatively, you can perform a zero at your preference. During zeroing a wait symbol is displayed.


**Figure 2-61** Zeroing pop-up

When the P- Series Power Sensor is initially connected to the power meter, it automatically performs a Zero and Calibration routine.

### When to Zero?

Zeroing of the power meter is recommended:

- When a 5 $^{o}$C change in temperature occurs.
- Every 24 hours.
- Prior to measuring low level signals. For example, 10 dB above the lowest specified power for your power sensor.

### Automatic Zero

The automatic zero can be enabled as follows:

- Click F7 Cal , **1 of 3** and toggle the **Auto Zero A** to On.

The **Zeroing** pop- up is displayed when a zero occurs.

**NOTE** When you are performing measurements, this may cause delays in obtaining results. During this time, it is recommended to disable the automatic zeroing.

### Manual Zeroing

To manually zero the power meter and sensor:

- Click F7 Cal and the channel **Zero** softkey. Click **Zero A**, **Zero B** or **Zero Both** to start the zeroing routine.

  The **Zeroing** pop- up is displayed.

## Calibration

Calibration sets the gain of each power meter channel and P- Series sensor combination. This is achieved without the need to connect it to the 1.0 mW Power Reference. The power meter can be set to automatically calibrate *on- the- fly* while you are using it. Alternatively, you can perform the calibration manually. The reference calibration factor is automatically set for all P- Series Power Sensors.

During calibration, the wait symbol is displayed.

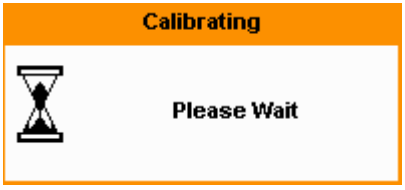



**Figure 2-62** Calibration wait pop-up

Offset and relative settings are ignored during calibration.

### Manual Calibration

To manually calibrate the power meter and sensor combination:

1 Click 

and the channel **Cal** softkey. Click **Cal A** or **Cal B** to start the calibration routine.

The **Calibrating** pop- up is then displayed.

**Tip** You can reduce the steps required to carry out the manual zero and calibration procedure as follow:

Click 

and **Zero + Cal** . Click **Zero + Cal A** or **Zero + Cal B** as required.

## Zero/Cal Lockout

The Zero/Cal Lockout facility can help you make sure that a measurement cannot be made until the power meter and sensor combination has been zeroed and calibrated.

When the Zero/Cal Lockout facility is enabled and a sensor is initially connected, the message **Please Zero and Cal** is displayed.

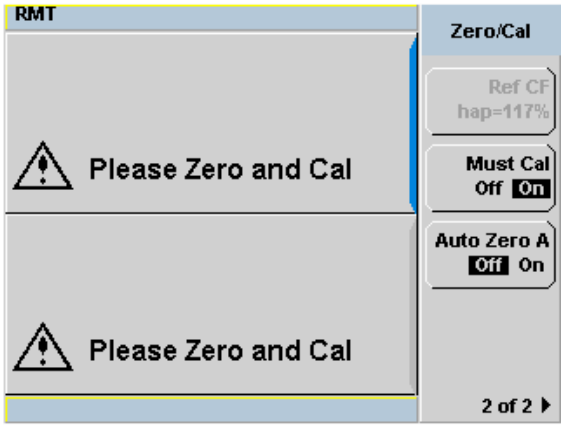



**Figure 2-63** Please Zero and Calibrate window

When you zero the sensor the message changes to **Please Cal**. If you calibrate the sensor before zeroing it, the message changes to **Please Zero**.

Dual channel meters display channel specific messages when a sensor is connected. The Zero/Cal Lockout configuration is applied to both channels - it cannot be applied to one channel only.

You can enable and disable the Zero/Cal Lockout facility from the System menu or the Cal menu as follow:

Click F1 System, **1 of 2**, **Must Cal** **Off** or **On**.

Similarly,

click F7 Cal, **1 of 3**, **Must Cal** **Off** or **On**.

# Presetting the Power Meter

This section details the power meter's preset conditions.

Click the Preset to display the preset options as shown in Figure 2- 64.

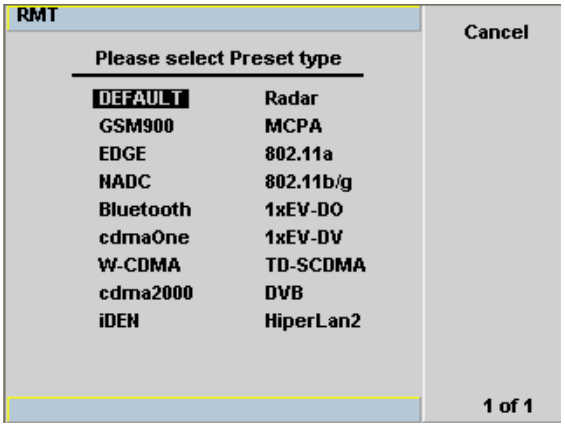



**Figure 2-64** Preset display options

The remote addresses, the data stored in the sensor calibration tables, the calibration table selected, and the zeroing and calibration data are not affected by a preset.

**NOTE** For all preset states, total of two windows are displayed.

# 3
# Using P-Series Power Sensor



This chapter describes how to use your P-Series Power Sensor with your P-Series Modular Power Meter.

# Introduction

The P- Series Wideband Power Sensor's mode of operation is optimized to measure the peak and average power of pulsed or modulated signals with a wide bandwidth.

The power meter automatically recognizes a P- Series Wideband Power Sensor when it is connected. The sensor's calibration data, characterizing the sensor output versus input power, frequency and temperature, is automatically read by the power meter. After the sensor's data is read, the power meter automatically performs a zeroing and calibration, this process is described in "Zeroing and Calibrating the P- Series Sensor" on page 92.

The power meter and/with P- Series Wideband Power Sensor continuously samples the RF signal at 100 mega- samples per second.

The instantaneous power of an RF signal can be detected with up to 30 MHz of video* bandwidth (modulation bandwidth).

The triggering methods used by the system (power meter and sensor) enable the continuous measurement of modulated signals or single events. A trigger can be taken from a rising or falling edge of an RF signal pulse or controlled externally.

**NOTE** Maximum dynamic range is related to the maximum sensor bandwidth. Refer to the documentation supplied with your P-Series Wideband Power Sensor for specification information.

* The term *video* is applied to a signal that has been amplitude demodulated from an RF carrier, but contains components in the RF part of the spectrum. For a power meter it refers to the output of the sensor diodes.

# Configuring a Power Measurement

While the P- series Modular Power Meter may at first seem complex, configuring a measurement and displaying the results can be quickly achieved.

You can configure the required measurements using the data entry from the channel setup gate and trace menus.

However, it is easier using the trace display's **Gate Control** and **Trace Control** menus to configure your initial set up, as it is a more interactive process and may require less iterations between channel, triggering, gate, and display functions to make a measurement.

Before configuring the measurements, you should have some information about the signal you want to measure. For example, the following information can help you quickly establish stable triggering and reliable measurement data:

- The Center Frequency (CF)
- The bandwidth of any modulating signal
- The expected maximum and minimum power levels
- Timing information for any pulsed signals

# Setting the Trace Display

The P- Series Modular Power Meter is optimized to operate in the trace display mode when measuring a pulsed signal.

The swiftest method to get the power meter into a trace display is described in the following procedure:

**NOTE** The procedure assumes you are starting from a default preset.

1. Connect the power sensor to the power meter and connect it to the power source
2. Set the **Channel Frequency**
3. Set the **Trigger** to **Continuous**
4. Set the **Display** to **Trace**
5. Expand window and use the **Gate** control and **Trace** control menus to set the gate markers, trigger delay, and scale.

**NOTE** You can return to other menus later to add more accuracy on the measurement, for example, **Channel Setup**, to set the measurement average, the video average and the bandwidth of a modulating signal.

6. When you are satisfied with the configuration you may want to save it for future use. See "Saving and Recalling Power Meter States" on page 89 for further information.

### Step 1. Connecting the Power Sensor

When you initially connect a P- Series Wideband Power Sensor to the power meter, the sensor's calibration data is automatically read by the power meter. After the sensor's data is read, the power meter automatically performs a zero and calibration, see "Zeroing and Calibrating the P- Series Sensor" on page 92 for further information.

Connect the sensor to the power source.

### Step 2. Setting the Channel Frequency

- Click F2 Channel. Click **Channel** to select the channel you want to configure. The **Channel Setup** screen is displayed.
- Use the ◀, ▶, ▲, and ▼ softkeys to highlight the frequency field. Click SELECT to configure the setting. See "Setting the Measurement Frequency" on page 34 for further information.

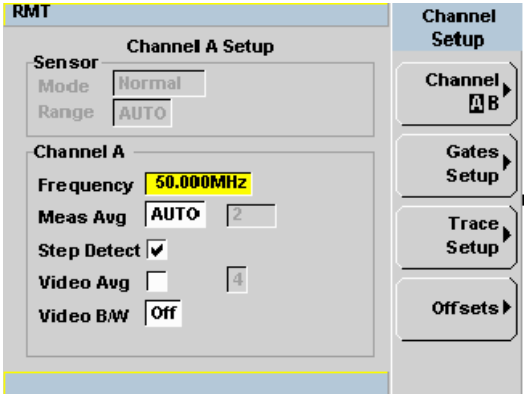



**Figure 3-1** P-Series sensor default channel setup

When you have completed the procedure you can return to this menu later to add more accuracy to the measurement.

### Step 3. Setting the Trigger

To use the measurement gates the power meter must be triggered.

A trigger can be taken from a rising or falling measured power level or controlled externally using the Ext Trig input.

- Click F3 Trig/Acq. The **Trigger** menu is displayed.

  The trigger status is displayed below the **Acqn** label in the **Trigger** menu. Click the **Acqn** softkey and select **Cont Trig** to configure continuous triggering.

  When you have completed the procedure you may return to the **Trigger** menu later to add more accuracy to the remaining trigger parameters, to help you achieve a stable and reliable trigger.

**NOTE** The **Acqn** can be set independantly for each channel

### Step 4. Setting the Display to Trace

Using trace display provides a visual representation of the signal of interest.

- Click F5 Disp, **Disp Type**, **Trace** to display the Trace the highlighted window.

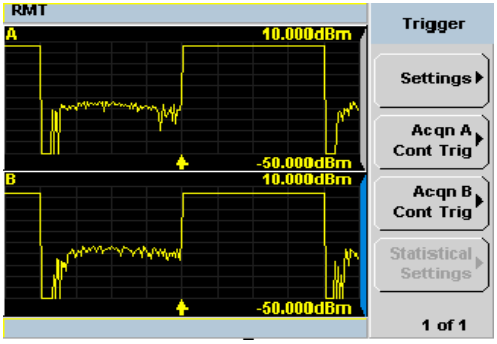



**Figure 3-2** Trace display in dual channel power meter

- Use the  ,  , or  softkeys to select a measurement window. Choose the type of display you require from the menu.

### Step 5. Expanding the Trace Display

Expanding the trace to display a **Single Enlarged Window** provides a more detailed visual representation of the signal of interest and display of the measured results. Figure 3- 3 is an example of this display. This display type also provides a visual method of setting up the gate, trigger delay, and trace controls.

Use the  softkey to configure the display from two rectangular windows to a single enlarged window, or a full screen display by clicking repeatedly. The display style is applied to the currently highlighted window.

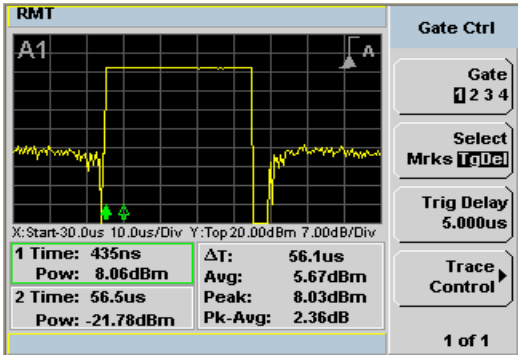



**Figure 3-3** Trace display in single enlarged window

**NOTE**

When you alter a parameter in another menu, you are returned to a two window display. Use the  ,  , or  softkeys to highlight the trace measurement window and use the  softkey to enlarge the display.

**NOTE** If the bandwidth of a modulated signal is unknown, you may discover that during the set up process, a power sensor of lesser or greater bandwidth is required.

After you have completed this initial set up, you can, if required, return to the following setup to improve your measurement results:

- The **Channel Setup** to configure any averaging and offsets.
- The **Trigger** setup to configure any additional setting there.
- The **Meas Setup** to configure any additional setting there.

### Gate Control in a Single Enlarged Window

When you initially display a Single Enlarged Window, the **Gate Control** menu is available. Setting the gate features are described in greater detail in "Setting Measurement Channel Gates" on page 59. However, the following sections are to give you an overview of the control and their impact on the displayed results.

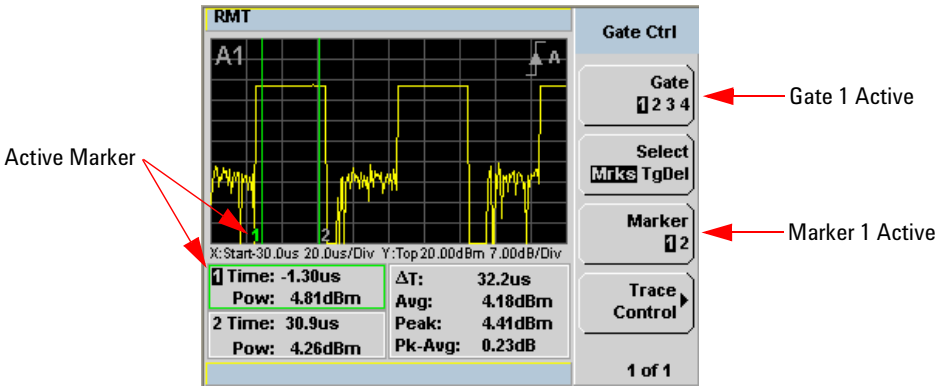



**Figure 3-4** Trace display with gate control menu

**Gate** Clicking Gate scrolls through the 4 gates available for each channel. The gate displayed is highlighted below the Gate softkey. It is also displayed in the channel/gate annotation in the top left of the screen.

**Select** Clicking **Select Mrks Tgdel** displays the gate markers or trigger markers.

**Markers** When **Mrks** is selected, Markers **1** and **2** indicate the start and end points of the selected measurement gate. Clicking **Marker** toggles between the two markers, the highlighted marker is the currently active marker. Use the ◀ and ▶ softkeys to move the markers left or right across the display.

The tables on the lower left of the screen show the time (**Time:**) and the instantaneous power level (**Pow:**) of the markers at their configured points. The table highlighted with the green border represents the active marker, also highlighted in green. A negative time value indicates a measurement before the trigger point. (See Figure 3- 4).

**NOTE** Gate timing parameters are all related to your chosen trigger point. This may be different from the timing of the triggering event if you have configured a trigger delay.

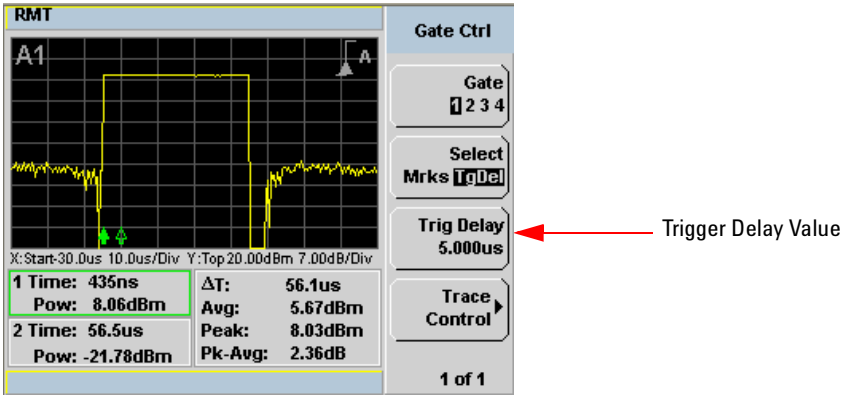



**Figure 3-5** Trace display with trigger delay menu

**TgDel** When **TgDel** is selected you can adjust the trigger delay. The display changes to remove the gate markers and displays the trigger marker(s). The ▲ indicates when the trigger event occurs, whilst △ shows the delayed trigger point. When the two points coincide, only the ▲ trigger is shown.

The configured value is displayed below the **Trig Delay** softkey. This value is shown in Figure 3-5.

To indicate an off-screen trigger event, ◄ is displayed. To indicate an off-screen trigger point, ◄► is displayed.

**NOTE** Your chosen trigger point is used as the reference point for the timing of all the measurement gates.

**Trig Delay** The trigger delay value is shown below the **Trig Delay** softkey. You configure the trigger delay by clicking **Trig Delay** and entering a numeric value in the pop-up window.

Clicking **Select** highlights **Mrks** to display the trace markers again.

**NOTE** You can also setup the trigger delay in the **Trigger** menu, by clicking **Settings**, **Delay** and entering a value in the pop-up window.

**Trace Control** Click **Trace Control** to display the **Trace Control** menu. Setting the trace features are described in greater details in "Setting up the Channel Trace" on page 62.

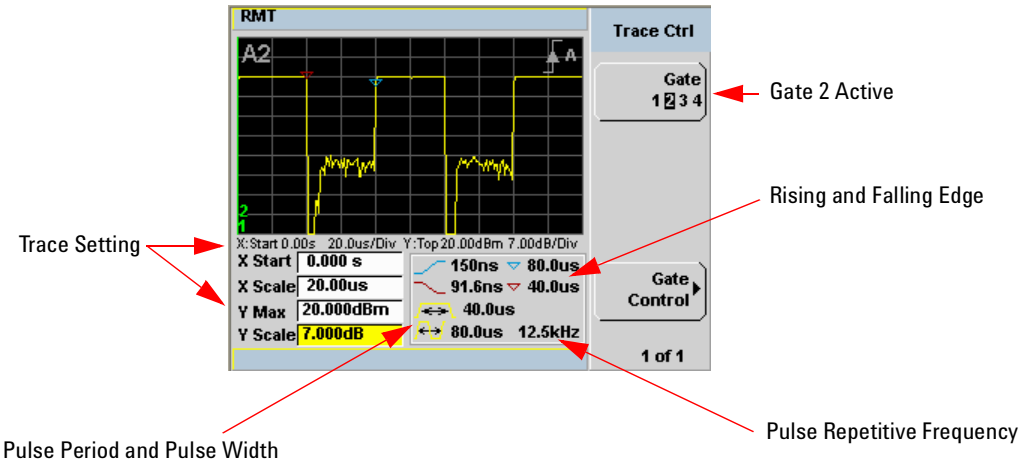



**Figure 3-6** Trace display with trace control menu

The fields on the lower left of the screen are the X and Y trace setup fields. Using the ⇧ or ⇩ softkeys you can highlight the item and change its value. (See Figure 3- 6)

The table on the lower right of the screen shows the 7automatic time measurements performed on the first complete captured pulse after the trigger. The 7 measurements are rise time, fall time, time to positive occurrence, time to negative occurrence, pulse width, pulse period (pulse repetitive interval) and pulse repetitive frequency.

The current settings of the X and Y scale are displayed on the reporting line above both tables.

**NOTE** If you want to view the trace in linear mode, the **Trace Setup** is the only location where you can change the Y-scale units from **dBm** to **Watts**; otherwise the default unit is in logarithmic.

**Gate Control** Click Gate Control to display the **Gate Ctrl** menu. Setting the gate features are described in greater details in "Gate Control in a Single Enlarged

Window" on page 104".

### Viewing the Results in a Full Screen Window

Use the  softkey to display the trace in a full screen window display. This provides a better resolution on the display. You can click **Trace Meas** or **Gate Meas** to display the results as set in **Single Enlarged Window** mode. The current settings of the X and Y scale are displayed on the reporting line above the results. You need to toggle the  softkey to allow the softkeys to be displayed.

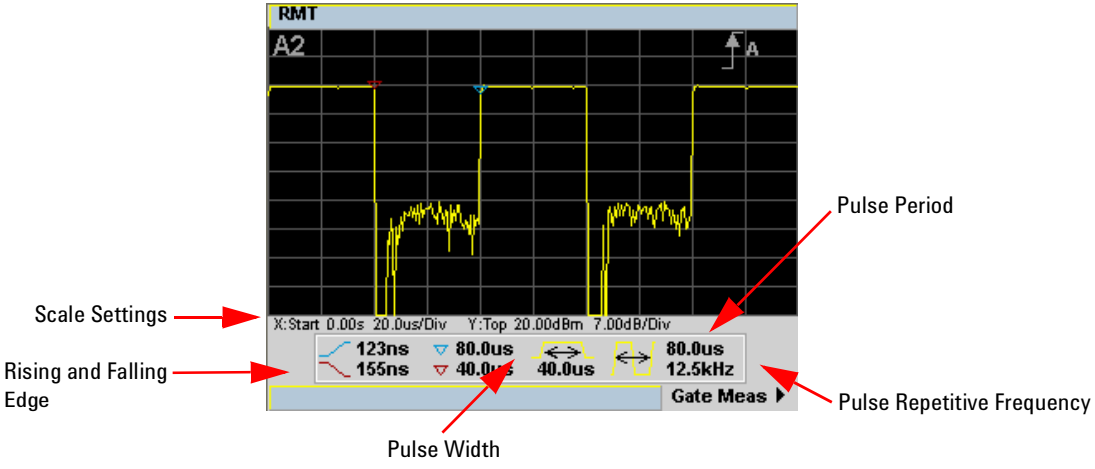



**Figure 3-7** Trace display in full screen

# Improving the Accuracy with Additional Settings

You can now return to the setup menus and adjust the default setting to obtain greater measurement accuracy.

### Channel Setup

- Click F2 Channel. Click Channel to select the channel you want to configure. The **Channel Setup** screen is displayed.

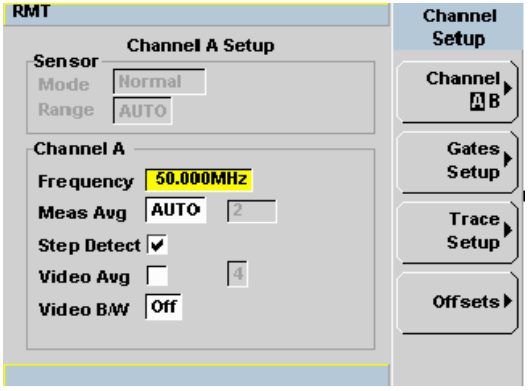



**Figure 3-8** P-Series Power Sensor dafault channel setup

Use the ◀, ▶, ▲, and ▼ softkeys to highlight the setting field and click SELECT to configure the setting. For further detail on these settings, refer to the appropriate sections.

- **Meas Avg:** "Setting Measurement Averaging" on page 51
- **Video Avg:** "Setting the Video Averaging" on page 54
- **Step Detect:** "Step Detection" on page 53
- **Video B/W:** "Setting the Video Bandwidth" on page 56

### Setting Offsets

Click **Offsets** . The **Offsets Setup** screen is displayed.

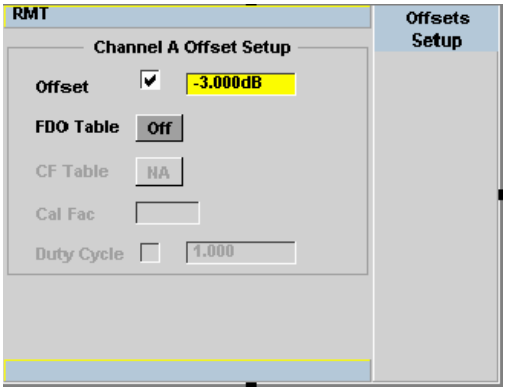



**Figure 3-9** Channel offset display

Use the ◀, ▶, ▲, and ▼ softkeys to highlight any parameters you want to change. Click SELECT to configure the required settings. For further detail on setting these, refer to the appropriate section.

- **Offset:** “Setting Channel Offsets” on page 41
- **FDO Table:** “Setting Frequency Dependent Offsets” on page 44

### Trigger Setup

Press F3 Trig/Acq . The **Trigger** menu is displayed.

The trigger status is displayed below the **Acqn** label in the **Trigger** menu.

Click the **Settings** softkey and add more accuracy to the remaining trigger parameters, for example, hold- off and hysteresis, to help you achieve a stable and reliable trigger. Hence, this ensures that the gates you have set up are capturing the required signal information. See Chapter 2, “Setting the Trigger,” starting on page 66 for further information.

### Measurement Setup

Press F4 Meas . The **Measurement Setup** menu is displayed.

Use the ◀, ▶, ▲, and ▼ softkeys to highlight the setting field and click SELECT to configure the setting.

When you have configured the measurements gates, you can assign the measurement feed and display the results in numeric formats. For example, dual numeric display with Gate 1 peak measurement minus Gate 3 peak measurement. Also, from this menu you can add offsets and measurement limits. For further detail on these settings, refer the appropriate section.

- **Feed1/2** "Setting the Measurement Display" on page 76
- **Offset** "Setting Display Offsets" on page 43
- **Limits** "Setting Measurement Limits" on page 72

### Display

Click F5 Disp . The **Display Form** menu is displayed.

Choose the display format to present the measurements results. The options, other than trace, are as follows:

**Single Numeric** If you need to configure the numeric format when using a P- Series sensor, refer to "Numeric Format" on page 77 for more details.

**Dual Numeric** If you need to configure the numeric format when using a P- Series sensor, refer to "Numeric Format" on page 77 for more details.

**Analog** If you need to configure the analog format when using a P- Series sensor refer to "Scaling the Analog Display" on page 83 for more details.

# Complementary Cumulative Distribution Function (CCDF)

Many of the present digitally modulated signals now look noise- like in the time and frequency domains. This means that statistical measurements of the signals can be a useful characterization. Power Complementary Cumulative Distribution Function (CCDF) characterizes the higher level power statistics of a digitally modulated signal.

The most important application of power CCDF is to specify, completely and without ambiguity, the power characteristics of the signals that will be mixed, amplified, and decoded in communication systems. For example, baseband DSP signal designers can completely specify the power characteristics of signals to the RF designers by using CCDF. This helps avoid costly errors at system integration time. Similarly, system manufacturers can avoid ambiguity by completely specifying the test signal parameters to their amplifier suppliers.

CCDF apply to many design applications. Some of these applications are:

- Visualizing the effects of modulation formats.
- Combining multiple signals via system's components (for example, amplifiers).
- Evaluating spread- spectrum systems.
- Designing and testing RF components.

## Viewing the CCDF Table

To view the CCDF table, click F5 Disp , **Disp Type** , **1 of 2** , and **CCDF Table** . In the CCDF table, you can view the data in 3 ways - windowed, expanded and full screen. The CCDF table is shown in windowed format by default. However you can click  once for expanded format and twice for full- screen.

**NOTE** CCDF is only allowed in Free Run mode, it cannot be used in Triggered mode. CCDF is only applicable to P-Series Wideband Power Sensors (N192xA family).

### Windowed CCDF Table

The CCDF table is shown in windowed format by default.

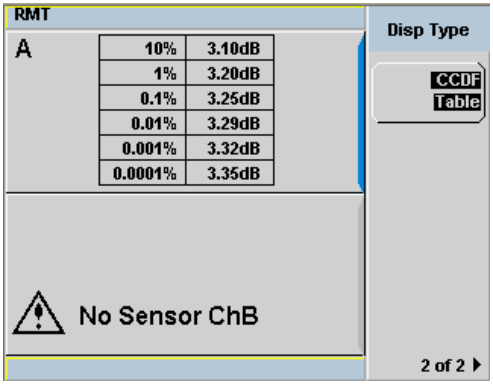



**Figure 3-10** CCDF table in windowed display

### Expanded CCDF Table

Click  once for an expanded view of the CCDF table.

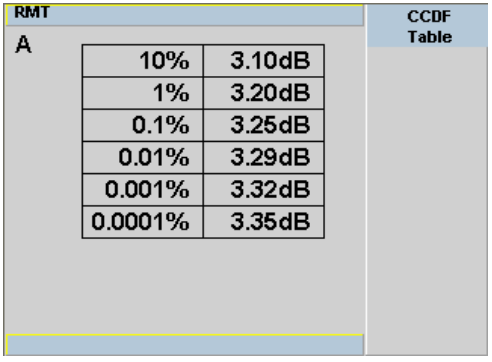



**Figure 3-11** CCDF table in expanded display

### Full Screen CCDF Table

Click  twice for a full-screen view of the CCDF table.

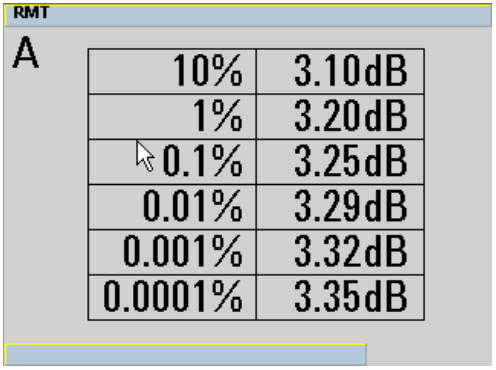



**Figure 3-12** CCDF table in full-screen display

# 4 Maintenance



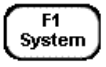
This chapter describes the built in tests, error messages and general maintenance.

# Self Test

The power meter has two self test modes:

- Power on self test - occurs automatically when you turn on the power meter.
- Troubleshooting mode - accessed via the P-series Soft Front Panel. The soft front panel softkey menu allows you to run individual tests, whereas the remote command runs a complete series of tests as listed in"Remote Testing" on page 119.

## Front Panel Selection of Self Tests

Click 

, **1 of 2** , **Service** , **Self Test** to access the **Self Test** menu consisting of the following:

- Instrument Self Test

## Instrument Self Test

If **Self Test** is selected, the following tests are run: (These are the same tests which are run using the `*TST?` command.)

- Test Point Voltages
- Calibrator
- Fan
- Battery
- Channel Peak Path
- Channel CW Path
- Channel DAP Check

As each test takes place, the name of the test is listed on the screen. While a test is running, the message **Testing...** appears beside the name of the test. As each stage of the test is completed, the **Testing...** message is replaced by either **Passed** or **Failed**.

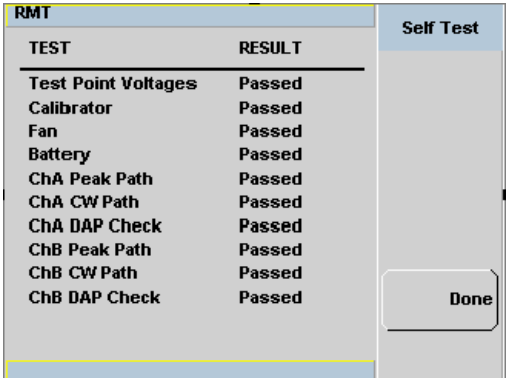



**Figure 4-1** Self test complete

When the test is complete, the result is displayed. Click **Done** to return to the **Service** menu.

If the self test failed, information about the failure is displayed on the screen.

**NOTE**

"Unterminated Query" and "Hardware Missing" error messages will be logged during self test.

- "Unterminated Query" will be logged if the system is busy processing and no response to P-Series Soft Front Panel application.
- "Hardware Missing" will be logged as the self test will disconnect the sensor during certain stage self test.

## Remote Testing

To invoke the remote self test, the IEEE 488.1 compliant standard command, `*TST?` is used. This command runs a full self test and returns one of the following codes:

- 0 - no tests failed
- 1 - one or more tests failed

The remote self test consists of the following tests:

The communications assembly is tested implicitly, in that the command will not be accepted or return a result unless the remote interface is functioning correctly.

Refer to "Test Descriptions" on page 119 if you require a description of each individual test.

When the `*TST?` command is executed, the screen is cleared. As each test takes place, the name of the test is listed on the screen. While a test is running, the message **Testing...** appears beside the name of the test. As each stage of the test is completed, the message **Testing...** is replaced by either the message **Passed** or **Failed**.

## Test Descriptions

- This section specifies what is actually checked by each of the tests. Some of the tests may only be applicable to one method of invocation (for example, from the soft front panel). If this is the case, it is specified in the test description. Most of the tests have an associated error message which is added to the error queue if the test fails. Refer to "Error Messages" on page 120 for more details.

### Fan

This test confirms that the internal cooling fan is operating.

### Calibrator

The reference calibrator is turned on (indicated by the POWER REF LED) and measured internally. A pass or fail result is returned.

# Error Messages

## Introduction

This section contains information about error messages. It explains how to read the power meter's error queue and lists all error messages and their probable causes.

When there is a hardware related problem, for example, a power sensor overload, the error message is displayed on the status line at the top of the display. In addition, the errors are also written to the error queue. If there are any errors in the error queue the soft front panel error indicator is displayed as shown in Figure 4- 2.

Other errors can also be generated when the power meter is being operated over the remote interface. These errors also display the error indicator and are written to the error queue.

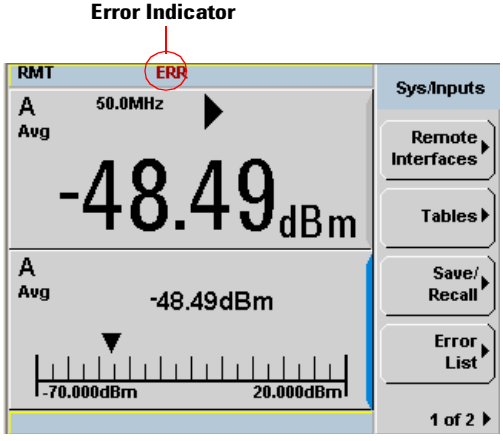



**Figure 4-2** Error indicator position

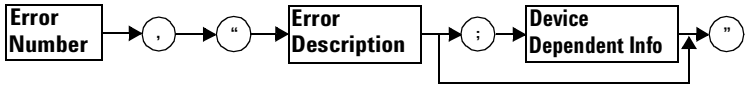
To read the error queue from the front panel:

- Click F1 System , **1 of 2** , **Service** , **Error List** and use **Next** to scroll through each error message.

To read the error queue from the remote interface use:

- the `SYSTem:ERRor?` command.

Error queue messages have the following format:




Error Queue Message

For example, –330, “Self- test Failed;Battery Fault”.

Errors are retrieved in a first in first out (FIFO) order. If more than 30 errors occur, the error queue overflows and the last error in the queue is replaced with error –350, “Queue Overflow”. Any time the queue overflows the most recent error is discarded.

When the errors are read they are removed from the error queue. This opens a position at the end of the queue for a new error message, if one is subsequently detected. When all errors have been read from the queue, further error queries return +0, “No errors”.

To delete all the errors in the queue from the front panel click:

- Click F1 System, **1 of 2** , **Service** , **Error List** and use **Clear Errors**.

To delete all the errors in the queue remotely use:

- the `*CLS` (clear status) command.

The error queue is also cleared when the instrument power has been switched off.

# Error Message List

| | |
|---|---|
| –101 | Invalid character<br><br>An invalid character was found in the command string. You may have inserted a character such as #, $, or % in the command header or within a parameter.<br>For example, LIM:LOW 0#. |
| –102 | Syntax error<br><br>Invalid syntax was found in the command string.<br>For example, LIM:CLE:AUTO, 1 or LIM:CLE: AUTO 1. |
| –103 | Invalid separator<br><br>An invalid separator was found in the command string. You may have used a comma instead of a colon, semicolon, or blank space; or you may have used a blank space instead of a comma.<br>For example, OUTP:ROSC,1. |
| –105 | GET not allowed<br><br>A Group Execute Trigger (GET) is not allowed within a command string. |
| –108 | Parameter not allowed<br><br>More parameters were received than expected for the command. You may have entered an extra parameter, or added a parameter to a command that does not accept a parameter.<br>For example, CAL 10. |
| –109 | Missing parameter<br><br>Fewer parameters were received than expected for the command. You omitted one or more parameters that are required for this command. For example, AVER:COUN. |
| –112 | Program mnemonic too long<br><br>A command header was received which contained more than the maximum 12 characters allowed.<br>For example, SENSeAVERageCOUNt 8. |

| | |
|---|---|
| –113 | Undefined header<br><br>A command was received that is not valid for this power meter. You may have misspelled the command, it may not be a valid command or you may have the wrong interface selected. If you are using the short form of the command, remember that it may contain up to four letters.<br>For example, TRIG:SOUR IMM. |
| –121 | Invalid character in number<br><br>An invalid character was found in the number specified for a parameter value.<br>For example, SENS:AVER:COUN 128#H. |
| –123 | Exponent too large<br><br>A numeric parameter was found whose exponent was larger than 32,000.<br>For example, SENS:COUN 1E34000. |
| –124 | Too many digits<br><br>A numeric parameter was found whose mantissa contained more than 255 digits, excluding leading zeros. |
| –128 | Numeric data not allowed<br><br>A numeric value was received within a command which does not accept a numeric value.<br>For example, MEM:CLE 24. |
| –131 | Invalid suffix<br><br>A suffix was incorrectly specified for a numeric parameter. You may have misspelled the suffix.<br>For example, SENS:FREQ 200KZ. |
| –134 | Suffix too long<br><br>A suffix used contained more than 12 characters.<br>For example, SENS:FREQ 2MHZZZZZZZZZZ. |
| –138 | Suffix not allowed<br><br>A suffix was received following a numeric parameter which does not accept a suffix.<br>For example, INIT:CONT 0Hz. |

| | |
|---|---|
| –148 | Character data not allowed<br><br>A discrete parameter was received but a character string or a numeric parameter was expected. Check the list of parameters to verify that you have used a valid parameter type.<br>For example, MEM:CLE CUSTOM_1. |
| –151 | Invalid string data<br><br>An invalid string was received. Check to see if you have enclosed the character string in single or double quotes.<br>For example, MEM:CLE “CUSTOM_1. |
| –158 | String data not allowed<br><br>A character string was received but is not allowed for the command. Check the list of parameters to verify that you have used a valid parameter type.<br>For example, LIM:STAT ‘ON’. |
| –161 | Invalid block data<br><br>A block data element was expected but was invalid for some reason. For example, *DDT #15FET. The 5 in the string indicates that 5 characters should follow, whereas in this example there are only 3. |
| –168 | Block data not allowed<br><br>A legal block data element was encountered but not allowed by the power meter at this point.<br>For example, SYST:LANG #15FETC?. |
| –178 | Expression data not allowed<br><br>A legal expression data was encountered but not allowed by the power meter at this point.<br>For example, SYST:LANG (5+2). |
| –211 | Trigger ignored<br><br>Indicates that <GET> or *TRG, or TRIG:IMM was received and recognized by the device but was ignored because the power meter was not in the wait for trigger state. |

| | |
|---|---|
| –213 | Init ignored<br>Indicates that a request for a measurement initiation was ignored as the power meter was already initiated.<br>For example, INIT:CONT ON<br>INIT. |
| –214 | Trigger deadlock<br>TRIG:SOUR was set to HOLD or BUS and a READ? or MEASure? was attempted, expecting TRIG:SOUR to be set to IMMediate. |
| –220 | Parameter error;Frequency list must be in ascending order.<br>Indicates that the frequencies entered using the MEMory:TABLe:FREQuency command are not in ascending order. |
| –221 | Settings conflict<br>This message occurs under a variety of conflicting conditions. The following list gives a few examples of where this error may occur:<br>If the READ? parameters do not match the current settings.<br>If you are in fast mode and attempting to switch on for example, averaging, duty cycle or limits.<br>Trying to clear a sensor calibration table when none is selected. |
| –222 | Data out of range<br>A numeric parameter value is outside the valid range for the command.<br>For example, SENS:FREQ 2 kHZ. |
| –224 | Illegal parameter value<br>A discrete parameter was received which was not a valid choice for the command. You may have used an invalid parameter choice.<br>For example, TRIG:SOUR EXT. |
| –226 | Lists not same length<br>This occurs when SENSe:CORRection:CSET[1]\|CSET2:STATe is set to ON and the frequency and calibration/offset lists do not correspond in length. |

| | |
|---|---|
| –230 | Data corrupt or stale<br><br>This occurs when a FETC? is attempted and either a reset has been received or the power meter state has changed such that the current measurement is invalidated (for example, a change of frequency setting or triggering conditions). |
| –230 | Data corrupt or stale;Please zero and calibrate Channel A<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel A has not been zeroed and calibrated, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message. |
| –230 | Data corrupt or stale;Please zero and calibrate Channel B<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel B has not been zeroed and calibrated, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message. |
| –230 | Data corrupt or stale;Please zero Channel A<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel A has not been zeroed, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message. |
| –230 | Data corrupt or stale;Please zero Channel B<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel B has not been zeroed, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message |
| –230 | Data corrupt or stale;Please calibrate Channel A<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel B has not been calibrated, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message |
| –230 | Data corrupt or stale;Please calibrate Channel B<br><br>When CAL[1\|2]:RCAL is set to ON and the sensor currently connected to Channel B has not been calibrated, then any command which would normally return a measurement result (for example FETC?, READ?, or MEAS?) will generate this error message |

| | |
|---|---|
| –231 | Data questionable;CAL ERROR<br>Power meter calibration failed. The most likely cause is attempting to calibrate without applying a 1 mW power to the power sensor. |
| –231 | Data questionable;CAL ERROR ChA<br>Power meter calibration failed on Channel A. The most likely cause is attempting to calibrate without applying a 1 mW power to the power sensor. |
| –231 | Data questionable;CAL ERROR ChB<br>Power meter calibration failed on Channel B. The most likely cause is attempting to calibrate without applying a 1 mW power to the power sensor. |
| –231 | Data questionable;Input Overload<br>The power input to Channel A exceeds the power sensor's maximum range. |
| –231 | Data questionable;Input Overload ChA<br>The power input to Channel A exceeds the power sensor's maximum range. |
| –231 | Data questionable;Input Overload ChB<br>The power input to Channel B exceeds the power sensor's maximum range. |
| –231 | Data questionable;Lower window log error<br>This indicates that a difference measurement in the lower window has given a negative result when the units of measurement were logarithmic. |
| –231 | Data questionable;Upper window log error<br>This indicates that a difference measurement in the upper window has given a negative result when the units of measurement were logarithmic. |
| –231 | Data questionable;ZERO ERROR<br>Power meter zeroing failed. The most likely cause is attempting to zero when some power signal is being applied to the power sensor. |
| –231 | Data questionable;ZERO ERROR ChA<br>Power meter zeroing failed on Channel A. The most likely cause is attempting to zero when some power signal is being applied to the power sensor. |

| | |
|---|---|
| –231 | Data questionable;ZERO ERROR ChB<br>Power meter zeroing failed on Channel B. The most likely cause is attempting to zero when some power signal is being applied to the power sensor. |
| –241 | Hardware missing<br>The power meter is unable to execute the command because either no power sensor is connected or it expects an E-series power sensor and one is not connected. |
| –310 | System error;Dty Cyc may impair accuracy with ECP sensor<br>This indicates that the sensor connected is for use with CW signals only. |
| –310 | System error;Ch A Dty Cyc may impair accuracy with ECP sensor<br>This indicates that the sensor connected to Channel A is for use with CW signals only. |
| –310 | System error;Ch B Dty Cyc may impair accuracy with ECP sensor<br>This indicates that the sensor connected to Channel B is for use with CW signals only. |
| –310 | System error;Sensor EEPROM Read Failed - critical data not found or unreadable<br>This indicates a failure with your E-Series Power Sensor. Refer to your power sensor manual for details on returning it for repair. |
| –310 | System error;Sensor EEPROM Read Completed OK but optional data block(s) not found or unreadable<br>This indicates a failure with your E-Series Power Sensor. Refer to your power sensor manual for details on returning it for repair. |
| –310 | System error;Sensor EEPROM Read Failed - unknown EEPROM table format<br>This indicates a failure with your E-Series Power Sensor. Refer to your power sensor manual for details on returning it for repair. |
| –310 | System error;Sensor EEPROM < > data not found or unreadable<br>Where < > refers to the sensor data block covered, for example, Linearity, Temp - Comp (temperature compensation).<br>This indicates a failure with your E-Series Power Sensor. Refer to your power sensor manual for details on returning it for repair. |

| | |
|---|---|
| –321 | Out of memory<br>The power meter required more memory than was available to run an internal operation. |
| –330 | Self-test Failed;<br>The -330, "Self-test Failed" errors indicate that you have a problem with your power meter. Refer to "Contacting Agilent Technologies" on page 132 for details of what to do with your faulty power meter. |
| –330 | Self-test Failed;Measurement Channel Fault |
| –330 | Self-test Failed;Measurement Channel A Fault |
| –330 | Self-test Failed;Measurement Channel B Fault |
| –330 | Self-test Failed;Calibrator Fault<br>Refer to "Calibrator" on page 119 if you require a description of the calibrator test. |
| –330 | Self-test Failed;ROM Check Failed |
| –330 | Self-test Failed;RAM Check Failed |
| –350 | Queue overflow<br>The error queue is full and another error has occurred which could not be recorded. |
| –361 | Parity error in program<br>The serial port receiver has detected a parity error and consequently, data integrity cannot be guaranteed. |
| –362 | Framing error in program<br>The serial port receiver has detected a framing error and consequently, data integrity cannot be guaranteed. |
| –363 | Input buffer overrun<br>The serial port receiver has been overrun and consequently, data has been lost. |

| | |
|---|---|
| –410 | Query INTERRUPTED<br>A command was received which sends data to the output buffer, but the output buffer contained data from a previous command (the previous data is not overwritten). The output buffer is cleared when power has been off, or after *RST (reset) command has been executed. |
| –420 | Query UNTERMINATED<br>The power meter was addressed to talk (that is, to send data over the interface) but a command has not been received which sends data to the output buffer. For example you may have executed a CONFigure command (which does not generate data) and then attempted to read data from the remote interface. |
| –430 | Query DEADLOCKED<br>A command was received which generates too much data to fit in the output buffer and the input buffer is also full. Command execution continues but data is lost. |
| –440 | Query UNTERMINATED after indefinite response<br>The *IDN? command must be the last query command within a command string. |

# Operator Maintenance

This section describes how to replace the power line fuse and clean the power meter. If you need additional information about replacing parts or repairing the power meter, refer to the *P- Series Modular Power Meter Service Guide*.

To clean the power meter, disconnect its supply power and wipe with a damp cloth only.

For all voltages the power meter uses a 250 V, F3.15 AH, 20 mm fast blow fuse with high breaking capacity (Agilent part number 2110- 0957).

**NOTE** The power meter has an internal fuse. If you suspect that this fuse needs to be replaced, it must be done by trained service personnel. Please refer to "Returning Your Power Meter for Service" on page 136.

# Contacting Agilent Technologies

This section details what to do if you have a problem with your power meter.

If you have a problem with your power meter, first refer to the section "Before calling Agilent Technologies". This chapter contains a checklist that will help identify some of the most common problems.

If you wish to contact Agilent Technologies about any aspect of the power meter, from service problems to ordering information, refer to "Agilent Sales and Service Offices" on page 138.

If you wish to return the power meter to Agilent Technologies refer to "Returning Your Power Meter for Service" on page 136.

## Before calling Agilent Technologies

Before calling Agilent Technologies or returning the power meter for service, please make the checks listed in "Check the Basics" on page 133. If you still have a problem, please read the warranty printed at the front of this guide. If your power meter is covered by a separate maintenance agreement, please be familiar with the terms.

Agilent Technologies offers several maintenance plans to service your power meter after warranty expiration. Call your Agilent Technologies Sales and Service Center for full details.

If the power meter becomes faulty and you wish to return the faulty instrument, follow the description on how to return the faulty instrument in the section "Contacting Agilent Technologies" on page 132.

## Check the Basics

Problems can be solved by repeating what was being performed when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair. Before calling Agilent Technologies or returning the power meter for service, please make the following checks:

- Check that the line socket has power.
- Check that the power meter is plugged into the proper ac power source.
- Check that the power meter is switched on.
- Check that the line fuse is in working condition.
- Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- Check the equipment settings in the procedure that was being used when the problem occurred.
- Check that the test being performed and the expected results are within the specifications and capabilities of the power meter.
- Check the power meter display for error messages.
- Check operation by performing the self tests.
- Check with a different power sensor.

## Instrument serial numbers

Agilent Technologies makes frequent improvements to its products to enhance their performance, usability and reliability. Agilent Technologies service personnel have access to complete records of design changes for each instrument. The information is based on the serial number and option designation of each power meter.

Whenever you contact Agilent Technologies about your power meter have a complete serial number available. This ensures you obtain the most complete and accurate service information. The serial number can be obtained by:

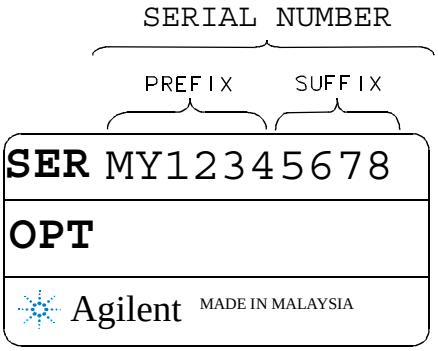
- interrogating the power meter over the remote interface using the *IDN? command.

- from the soft front panel by clicking F1 System, **1 of 2**, **Service**, **Version**.
- from the serial number label.

The serial number label is attached to the rear of each Agilent Technologies instrument. This label has two instrument identification entries. The first provides the instruments serial number and the second provides the identification number for each option built into the instrument.

The serial number is divided into two parts: the prefix (two letters and the first four numbers), and the suffix (the last four numbers).

- The prefix letters indicate the country of manufacture. This code is based on the ISO international country code standard, and is used to designate the specific country of manufacture for the individual product. The same product number could be manufactured in two different countries. In this case the individual product serial numbers would reflect different country of manufacture codes. The prefix also consists of four numbers. This is a code identifying the date of the last major design change.
- The suffix indicates an alpha numeric code which is used to ensure unique identification of each product throughout Agilent Technologies.



# Erasing Memory Data

If you need to erase the P- Series Modular Power Meter's memory, for example, before you return it to Agilent Technologies for repair or calibration, of all data stored in it.

The memory data erased includes the save/recall states and power on last states.

The following procedure explains how to do this.

1. Click the F1 System softkey.
2. Click **1 of 2** .
3. Click **Service** .
4. Click **Secure Erase** .
5. If you are sure, click the **Confirm** softkey.
6. A pop- up appears, as shown in Figure 4- 3 informing you of the status of the procedure.

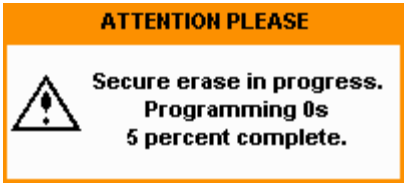



**Figure 4-3** Secure erase status pop-up

# Returning Your Power Meter for Service

Use the information in this section if you need to return your power meter to Agilent Technologies.

## Packaging the Power Meter for Shipment

Use the following steps to package the power meter for shipment to Agilent Technologies for service:

- Fill in a blue service tag (available at the end of this guide) and attach it to the power meter. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
  - Any error messages that appeared on the power meter display.
  - Any information on the performance of the power meter.

**CAUTION** Power meter damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the power meter or prevent it from shifting in the carton. Styrene pellets cause power meter damage by generating static electricity and by lodging in the rear panel.

- Use the original packaging materials or a strong shipping container that is made of double- walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the power meter and allow at least 3 to 4 inches on all sides of the power meter for packing material.
- Surround the power meter with at least 3 to 4 inches of packing material, or enough to prevent the power meter from moving in the carton. If packing foam is not available, the best alternative is SD- 240 Air Cap TM from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1- 1/4 inch air filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the power meter several times in the material to both protect the power meter and prevent it from moving in the carton.

- Seal the shipping container securely with strong nylon adhesive tape.
- Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.
- Retain copies of all shipping papers.

# Agilent Sales and Service Offices

In any correspondence or telephone conversations, refer to the power meter by its model number and full serial number. With this information, the Agilent representative can quickly determine whether your unit is still within its warranty period.

| | |
|---|---|
| UNITED STATES | Agilent Technologies<br>(tel) 1 800 829 4444 |
| CANADA | Agilent Technologies Canada Inc.<br>Test & Measurement<br>(tel) 1 877 894 4414 |
| EUROPE | Agilent Technologies<br>Test & Measurement<br>European Marketing Organization<br>(tel) (31 20) 547 2000 |
| JAPAN | Agilent Technologies Japan Ltd.<br>(tel) (81) 426 56 7832<br>(fax) (81) 426 56 7840 |
| LATIN AMERICA | Agilent Technologies<br>Latin America Region Headquarters, USA<br>(tel) (305) 267 4245<br>(fax) (305) 267 4286 |
| AUSTRALIA and<br>NEW ZEALAND | Agilent Technologies Australia Pty Ltd.<br>(tel) 1-800 629 4852 (Australia)<br>(fax) (61 3) 9272 0749 (Australia)<br>(tel) 0-800 738 378 (New Zealand)<br>(fax) (64 4) 802 6881 (New Zealand) |
| ASIA PACIFIC | Agilent Technologies, Hong Kong<br>(tel) (852) 3197 7777<br>(fax) (852) 2506 9284 |

Or visit Agilent's Website at http://www.agilent.com/find/assist.

# 5
# Specifications and Characteristics



This chapter describes the specifications and characteristics of your P-Series Modular Power Meter.

# Introduction

This chapter details the P- Series Modular Power Meters's specifications and supplemental characteristics. Information contained in this chapter refers to operation with P- Series Wideband Power Sensors.

## Specification Definitions

There are two types of product specifications:

- Warranted specifications
- Characteristic specifications

### Warranted specifications

Warranted specifications are covered by the product warranty and apply over 0 °C to 55 °C, unless otherwise noted. Warranted specifications include Measurement Uncertainty calculated with 95 % confidence.

### Characteristic specifications

Characteristic specifications are not warranted. They describe product performance that is useful in the application of the Power Sensors by giving typical, but non- warranted performance parameters. These characteristics are shown in *italics* or denoted as "*typical*", "*nominal*" or "*approximate*".

Characteristic information is representative of the product. In many cases, it may also be supplemental to a warranted specification. Characteristic specifications are not verified on all Power Sensors. The types of characteristic specifications can be placed in two groups:

- The first group of characteristic types describes 'attributes' common to all products of a given model or option.

  Examples of characteristics that describe 'attributes' are product weight, and 50 Ω input Type- N connector. In these examples product weight is an *approximate* value and a 50 Ω input is *nominal*. These two terms are most widely used when describing a product's 'attributes'.

- The second group of characteristic types describes 'statistically' the aggregate performance of the population of products.

  These characteristics describe the expected behavior of the population of products. They do not guarantee the performance of any individual product. No measurement uncertainty value is accounted for in the specification. These specifications are referred to as *typical*.

### Conditions

The Power Meter and Sensor meet its specifications when:

- Stored for a minimum of two hours at a stable temperature within the operating temperature range, and turned on for at least 30 minutes.
- The Power Meter and Power Sensor are within their recommended calibration periods.
- Used in accordance to the information provided in the *Modular Power Meter's User's Guide*.

### Measurement uncertainties

For information on measurement uncertainty calculations, refer to Agilent AN 1449- 1 to Agilent AN 1449- 4 "Fundamentals of RF and Microwave Power Measurements", Literature Number 5988- 9213EN to 5988- 9216EN.

# Power Meter Specifications

## Number of Channels

- N8262A P- Series Modular Power Meter, dual channel

## Frequency Range

- N1921A P- Series Wideband Power Sensor, 50 MHz to 18 GHz
- N1922A P- Series Wideband Power Sensor, 50 MHz to 40 GHz

## Dynamic Range

- –35 dBm to +20 dBm (> 500 MHz)
- –30 dBm to +20 dBm (50 MHz - 500 MHz)

## Measurements

The following Power measurements are provided with free- run or time gated definition.

- Average
- Peak
- Peak- to- Average

Time parameter measurements of pulse rise time, fall time, pulse width, time to positive occurrence, time to negative occurrence and pulse repetitive frequency are also provided.

## Power Sensors Compatibility

P- Series Modular Power Meter are compatible with all Agilent P- Series Wideband Power Sensors.

The P- Series Modular Power Meter also operates with the existing 8480 Series and E- Series (E4410 and E9300) ranges of Power Sensors.[1]

## Meter Uncertainty

| | |
|---|---|
| **Instrumentation Linearity** | ±0.8 % |

## Average Power Measurement Accuracy[2]

- N1921A: ≤± 0.2 dB or ±4.5 %
- N1922A: ≤± 0.3 dB or ±6.7 %

[1] For specifications when using an 8480 and E-Series Sensors, refer to Lit Number 5965-6382E.

[2] Specification is valid over –15 to +20 dBm, and a frequency range 0.5 to 10 GHz, DUT Max. SWR < 1.27 for the N1921A, and a frequency range 0.5 to 40 GHz, DUT Max. SWR < 1.2 for the N1922A. Averaging set to 32, in Free Run mode.

## Remote Programming

| | |
|---|---|
| **Interface:** | 10/100BaseT Lan Interface |
| **Command Language:** | SCPI standard interface commands[3] |

[3] The P-Series Modular Power Meter are not compatible with the 436A, 437B, or the 438A Power Meter command sets.

## Timebase

| | |
|---|---|
| **Timebase Range** | *2 ns to 100 msec/div* |
| **Accuracy** | ±10 ppm |
| **Jitter** | *≥1 ns* |

## Bandwidth

| | |
|---|---|
| **Video Bandwidth** | *≥30 MHz* |
| **Single Shot Bandwidth** | *≥30 MHz* |

**NOTE** The video bandwidth represents the ability of the Power Sensor and Meter to follow the power envelope of the input signal. The power envelope of the input signal is, in some cases, determined by the signal's modulation bandwidth, hence, video bandwidth is sometimes referred to as modulation bandwidth.

# Measurement Characteristics

## Trigger

| | |
|---|---|
| **Internal Trigger** | **Range:** *–20 to +20 dBm*<br>**Resolution:** *0.1 dB*<br>**Level Accuracy:** *±0.5 dB*<br>**Latency:**[4] *160 ns±10 ns*<br>**Jitter:** *≤ 5 ns rms* |
| **External TTL Trigger Input** | **High:** *>2.4 V*<br>**Low:** *<0.7 V*<br>**Latency:**[4] *90 ns±10 ns*<br>**Minimum trigger pulse width:** *15 ns*<br>**Minimum trigger repetition period:** *50 ns*<br>**Impedance:** *50 Ω*<br>**Jitter:** *≤ 5 ns rms* |
| **External TTL Trigger Output** | *Low to High transition on trigger event.*<br>**High:** *>2.4 V*<br>**Low:** *<0.7 V*<br>**Latency:**[4] *30 ns ±10 ns*<br>**Impedance:** *50 Ω*<br>**Jitter:** *≤ 5 ns rms* |
| **Trigger Delay** | **Delay range:** *±1.0 s, maximum*<br>**Delay resolution:** *1 % of delay setting (10 ns maximum)* |
| **Trigger Hold-off** | **Range:** *1 µs to 400 ms*<br>**Resolution:** *1 % of selected value (to a minimum of 10 ns)* |
| **Trigger Level Threshold Hysteresis** | **Range:** *±3 dB*<br>**Resolution:** *0.05 dB* |

[4] Latency is defined as the delay between the applied RF crossing the trigger level and the Power Meter switching into the triggered state.

## Measurement Speed

| | |
|---|---|
| **Measurement speed using remote interface** | *≥ 1500 readings per second* |

## Pulse Characteristic

These pulse characteristics are only applicable when a P- Series Wideband Sensor is used.

| | |
|---|---|
| **Rise Time and Fall Time** | *≤ 13 ns*[5,6] |
| **Minimum Pulse Width** | *50 ns*[7] |
| **Overshoot** | *≤ 5 %* |
| **Maximum Pulse Repetition Rate** | *10 MHz*[8] |

[5] Applies to frequencies >500 MHz (See Figure 5-1).

[6] Applies only when **Off** is selected for video bandwidth.

[7] The **Minimum Pulse Width** is the recommended minimum pulse width viewable on the Power Meter, where power measurements are meaningful and accurate, but not warranted.

[8] Based on 10 samples per period.

# Maximum Sample Rate and Capture Length

| | |
|---|---|
| **Maximum Sampling Rate** | *100 Msamples/second, continuous sampling* |
| **Maximum Capture Length** | *1 second* |

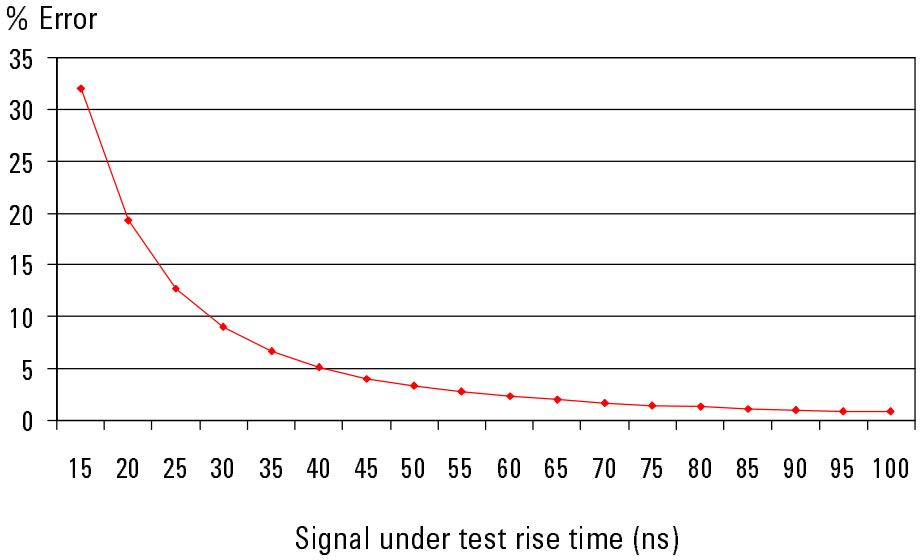



**Figure 5-1** Measured rise time percentage error versus signal under test rise time

Although the rise time specification is ≤13 ns, this does not mean that the P- Series Meter and Sensor combination can accurately measure a signal with a known rise time of 13 ns. The measured rise time is the root sum of the squares (RSS) of the signal under test rise time and the system rise time (13 ns).

$$\sqrt{((SignalUnderTestRiseTime)^2 + (SystemRiseTime)^2)}$$

$$\frac{(MeasuredRiseTime - SignalUnderTestRiseTime)}{(SignalUnderTestRiseTime) \times 100}$$

# Front Panel Inputs and Output Connections

| | |
|---|---|
| **Recorder Output(s):**[9] | Analog 0 to 1 V, 1 Ω output impedance, SMB connector |
| **Trigger Input:** | Input has TTL compatible logic levels and uses a SMB connector |
| **Trigger Out:** | Output provides TTL compatible logic levels and uses a SMB connector |

[9] Two recorder outputs are available on the N8262A P-Series Modular Power Meter.

# Rear panel Inputs and Outputs Connections

| | |
|---|---|
| **10/100BaseT LAN** | Interfaces allow communication with an external controller |
| **Ground:** | Binding post, accepts 4 mm plug or bare wire connection |

## Line Power

| | |
|---|---|
| **Input Voltage Range:** | 100 – 120 V ± 10 %<br>220 – 240 V ± 10 % |
| **Input Frequency Range:** | 50 – 60 Hz ± 10 % (all voltages)<br>400 – 440 Hz ± 10 % (100 – 120 V) |
| **Power Requirement:** | 50 VA (30 Watts)<br>(not exceeding 75 VA (50 Watts)) |

**WARNING** **A 3 kV, 100 kHz transient in the power line may cause the instrument to reset.**

# 1 mW Power Reference

**NOTE** The ***1mW Power Reference*** is provided for calibration of the E-Series and the 8480 Series Power Sensors. The P-Series Sensors are automatically calibrated, hence, do not need this power reference for calibration.

| | |
|---|---|
| **Power Output:** | 1.00 mW (0.0 dBm)<br>Factory set to ±0.4 % traceable to the National Physical Laboratories (NPL), UK |
| **Accuracy:**<br>**(over 2-years)** | ±1.2 % (0 - 55 °C)<br>±0.4 % (25 ± 10 °C) |
| **Frequency:** | *50 MHz nominal* |
| **SWR:** | 1.08 (0 - 55 °C)<br>*1.05 typical* |
| **Connector Type:** | Type N (f), 50 Ω |

# Environmental Conditions

## General

Complies with the requirements of the EMC Directive 89/336/EEC.

## Operating Environment

| | |
|---|---|
| **Temperature:** | 0 °C to 55 °C |
| **Maximum Humidity:** | 95 % at 40 °C (non-condensing) |
| **Minimum Humidity:** | 15 % at 40 °C (non-condensing) |
| **Maximum Altitude:** | 3,000 meters (9,840 feet) |

## Storage Conditions

| | |
|---|---|
| **Non-Operating Storage Temperature:** | –40 °C to +70 °C |
| **Non-Operating Maximum Humidity:** | 90 % at 65 °C (non-condensing) |
| **Non-Operating Maximum Altitude:** | 15,240 meters (50,000 feet) |

# Physical Characteristics

## Dimensions

The following dimensions exclude front and rear panel protrusions:

- 44.2 mm H x 212.6 mm W x 420.3 mm D (1.75 in x 8.5 in x 19.63 in)

## Weight

| | |
|---|---|
| **Weight (Net):** | *≤ 3.5 kg (7.7 lb) approximately* |
| **Weight (Shipping):** | *≤ 7.7 kg (17.0 lb) approximately* |

# Regulatory Information

## Electromagnetic Compatibility

This product complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

- Low Voltage Directive (73/23/EEC, amended by 93/68/EEC)
- EMC Directive (89/336/EEC, amended by 93/68/EEC)

and conforms with the following product standards:

| EMC | Standard | Limit |
|---|---|---|
| | IEC 61326-1:1997+A1:1998/EN 61326-1:1997+A1:1998<br>CISPR 11:1990/EN 55011:1991 | Class A, Group 1 |

The conformity assessment requirements have been met using the technical construction file route to compliance, using EMC test specifications EN 55011:1991 (Group 1, Class A). In order to preserve the EMC performance of the product, any cable which becomes worn or damaged must be replaced with the same type and specification.

The product also meets the following EMC standards:

- Australia/New Zealand: AS/NZS 2064.1
- Canada: ICES- 001:1998

## Product Safety

This product conforms to the requirements of the following safety standards:

- EN61010- 1: 2001 / IEC 61010- 1:2001
- Canada: CSA C22.2 No. 61010- 1:2004
- USA: UL: 61010- 1:2004

## Low Voltage Directive

This product conforms to the requirements of European Council Directive 73/23/EEC.

NOTE

### Regulatory Information for Canada

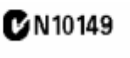
ICES/NMB-001:1998

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

### Regulatory Information for Australia/New Zealand

This ISM device complies with Australian/New Zealand AS/NZS 2064.1



# System Specifications and Characteristics

The video bandwidth in the meter can be set to High, Medium, Low and Off. The video bandwidths stated in the table below are not the 3 dB bandwidths, as the video bandwidths are corrected for optimal flatness (except the Off filter). Refer to Figure 5- 2 for information on the flatness response of the High, Medium, Low and Off filters. The Off video bandwidth setting provides the warranted rise time and fall time specification and is the recommended setting for minimizing overshoot on pulse signals.

## Rise Time, Fall Time, and Overshoot versus Video Bandwidth Settings

| Parameter | Video Bandwidth Setting | | | | |
|---|---|---|---|---|---|
| | Low: 5 MHz | Medium: 15 MHz | High: 30 MHz | Off | |
| | | | | < 500 MHz | > 500 MHz |
| Rise Time/ Fall Time[9] | *< 56 ns* | *< 25 ns* | *≤ 13 ns* | *< 36 ns* | *≤ 13 ns* |
| Overshoot[10] | - | - | - | < 5 % | < 5 % |

[9] Specified as 10 % to 90 % for rise time and 90 % to 10 % for fall time on a 0 dBm pulse.

[10] Specified as the overshoot relative to the settled pulse top power.

**NOTE** For option 107 (10 m cable), add 5 ns to the rise time and fall time specifications.

## Characteristic Peak Flatness

The peak flatness is the flatness of a peak- to- average ratio measurement for various tone- separations for an equal magnitude two- tone RF input. Figure 5- 2 refers to the relative error in peak- to- average ratio measurements as the tone separation is varied. The measurements were performed at –10 dBm with Power Sensors with 1.5 m cable lengths.

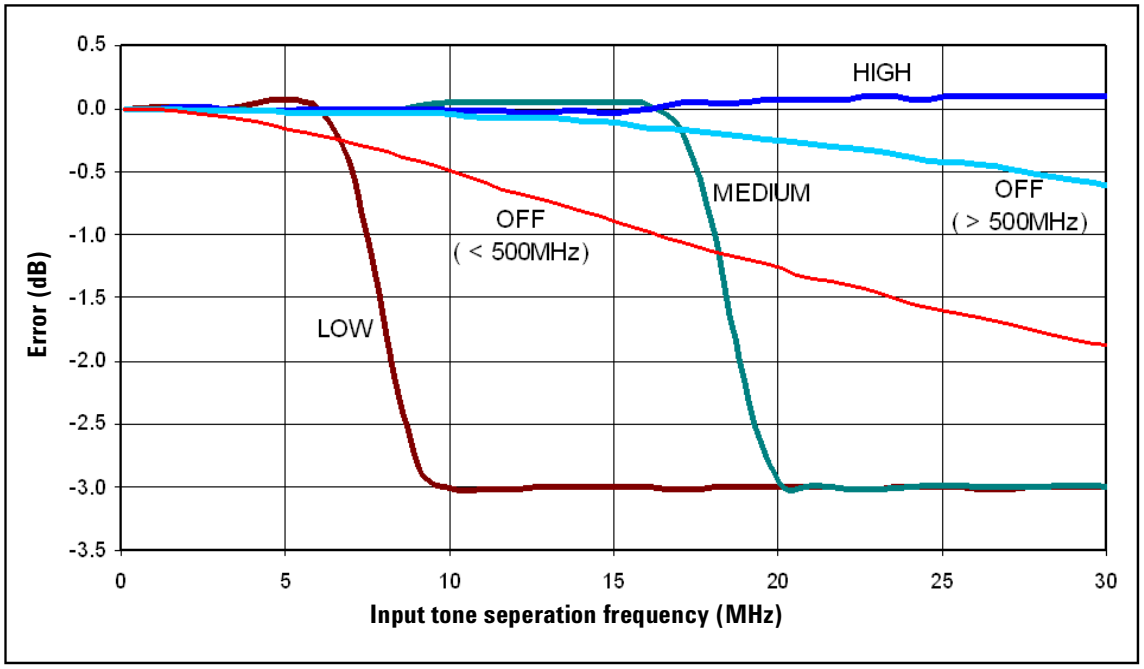



**Figure 5-2** P-Series Sensor error in peak-to-average measurements for a two-tone input

# Noise and Drift

| Sensor Model | Zeroing | Zero Set | | Zero Drift[11] | Noise per Sample | Measurement Noise (Free Run)[12] |
|---|---|---|---|---|---|---|
| | | <500 MHz | > 500 MHz | | | |
| N1921A/ N1922A | No RF at input | 200 nW | | *100 nW* | *2 µW* | *50 nW* |
| | RF Present | *550 nW* | 200 nW | | | |

[11] Within 1 hour after a zero, at a constant temperature, after 24 hour warm-up of the Power Meter. This component can be disregarded with Auto-zero mode set to ON.

[12] Measured over a one-minute interval, at a constant temperature, two standard deviations, with averaging set to 1.

| Measurement Average Setting | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 | 1024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Free Run Noise Multiplier | *1* | *0.9* | *0.8* | *0.7* | *0.6* | *0.5* | *0.45* | *0.4* | *0.3* | *0.25* | *0.2* |

| Video BW setting | | Low 5 MHz | Medium 15 MHz | High 30 MHz | Off |
|---|---|---|---|---|---|
| Noise per Sample Multiplier | < 500 MHz | *0.5* | *1* | *2* | *1* |
| | ≥ 500 MHz | *0.45* | *0.75* | *1.1* | *1* |

### Effect of Video Bandwidth Setting:

The noise per sample is reduced by applying the meter video bandwidth filter setting (High, Medium or Low). If averaging is implemented, this will dominate any effect of changing the video bandwidth.

### Effect of time-gating on measurement noise

The measurement noise on a time-gated measurement depends on the time gate length. 100 averages are carried out every 1 µs of gate length. The Noise-per-Sample contribution in this mode can approximately be reduced by ÷(gate length / 10 ns) to a limit of 50 nW.

# 5 Specifications and Characteristics

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## Contact us

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